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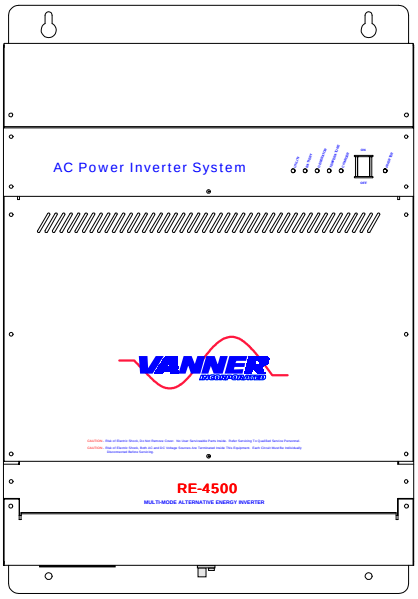
Hilliard Ohio, 43026
1(800) ACPOWER
www.vanner.com

RE SERIES

Renewable Energy True Sine Wave
AC Power Inverter/Charger
Owners Manual



Models decribed
RE24-4500
RE48-4500

Part #D99988
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Revision 1.0

Notes

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1 Introduction

Thank you for purchasing a Vanner RE-4500 Renewable Energy Inverter System. We are confident that you will be satisfied with its performance and its many features. With proper installation and care, you can look forward to years of service from this high performance product.

"***RE-4500***" stands for **R**enewable **E**nergy **4500** Watt, Inverter System. The specific model numbers covered in this document are the "***RE48-4500***" and "***RE24-4500***" which designate 48VDC or 24VDC respectively.

The ***RE SERIES*** is a family of dependable inverters designed to meet the service requirements of the Renewable Energy market and produce true sine wave AC output power.

This document will describe the operation and technical specifications of the RE24-4500 and accessories offered in this product family. We suggest that you acquaint yourself with this model inverter/charger and any optional accessories that you have purchased before proceeding with this manual. If you require additional information please contact your dealer, or contact us directly at 1-800-227-6937 (800 AC POWER).

WARNING:	**Before you install and use your *RE SERIES* Inverter/Charger be sure to read and save these safety instructions.**

WARNING:	**The RE-4500 is not designed to be a part of Life Supporting or Life Sustaining Equipment. If the Unit is to be used in such an application, please contact Vanner Inc. at 1-800-ACPOWER.**

The **RE SERIES** product line is designed to meet the requirements of a variety of applications.

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Save these instructions!

Please note your model and serial number here for future reference.

Model No._____

Serial No._____

Date of Installation_____

This document describes the operation, technical specifications and installation procedures for the RE-4500 Inverter/Charger System. If you require additional information please contact your dealer or contact Vanner at 1-800-AC POWER (1-800-227-6937).

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2 Specifications and Features

Table 2-1: RE-4500 Inverter/Charger Specifications

AC Power Output (Inverter Output)	
Rated Output Watts (-40 to +25°C)	4500 Watts
Continuous Output at 25°C (77°F)	4500 Watts
Continuous Output at 40°C (104°F)	3650 Watts
Continuous Output at 50°C (122°F)	3250 Watts
Continuous Output at 60°C (140°F)	3200 Watts
Max Continuous Output on L1 or L2	26.5 Amps (Electronically current limited)
3 Second Surge Output (at 24 VDC input, and 25ºC)	10000 VA
AC Maximum Output Fault Current	56.25 Arms (Inverter shuts down in 1/60 sec)
Output Waveform	True Sine Wave
Output Voltage, Single Phase, 3 Wire	120/240 Vrms ±5.0%
Output Frequency	60 Hz ± 0.01 Hz
Power Factor	-1 to 1
Charging or Grid Interactive Power Factor	Unity
% of Rated Charger Current Available at Full Charger Voltage	100%
Total Harmonic Distortion (THD)	5% Maximum
AC Output Wiring Method	Hardwire Terminal Strip
AC Transfer Switch	
Amperage Rating	30 Amp 240 Volt
Transfer Speed (a function of load)	16 milliseconds to 0.5 second (approx.)
From Inverter to Utility Power	16 ms
From Utility Power to Inverter w/ Grid Tie Enabled	1 second
From Utility Power to Inverter w/ Grid Tie Disabled	40 ms

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AC Operating Ratings	
AC Operating Voltage (Utility Interactive)	211.8 to 264 Vrms
AC Operating Voltage (Stand-alone)	211.8 to 264 Vrms
AC Maximum Output Current	18.75 Arms
AC Maximum Output Fault Current (Measured when L1 is shorted to L2.)	56.25 Arms
AC Maximum Input Current (From grid when charging)	30 amp APM rating 18.75 Arms for Inverter/Charger
AC Operating Frequency Range	59.75 Hz to 60.25 Hz
Output Neutral to Ground	Not Bonded (Good AC wiring practice dictates that bonding between neutral and ground should take place in the AC distribution panel only.)
Charger	
Maximum Charge Current Supported	100 ADC
Types of Charge supported	Bulk, Absorption, Float, and Equalize
Types of Batteries Supported	Lead Acid: Flooded-Cell, GEL, or AGM
DC Input Voltage (Inverter Input)	
DC Input Voltage Range	21.0 to 31.0 VDC - RE24-4500 41.0 to 62.0 VDC - RE48-4500
DC Input Current at 24VDC (Inverter Input)	
Inverter OFF	1 ma
Inverter in Load Demand (No AC load)	0.5 amps
Inverter ON with no AC load	2.0 amps
Inverter with full load at 22VDC (4500W @ 25°)	225 amps
System	
Generator Start & Low Battery Warning Control Relays Rating	2 Amps 120 VAC / 2 Amps up to 100VDC
Efficiency	80% Nominal (at 22VDC for 24V System, full load, at 44VDC for 48V System, full load) 90% peak
Ambient Operating Temperature	-40° to +40°C (-40 to +104°F) (to +60°C (+140°F) with de-rated output)
Cooling Air	Thermostatically Controlled Fan
Enclosure	Powder-Coated Aluminum / Wall Mounting
Dimensions	29½ H x 20½ W x 9¼ D
Unit Weight	95 pounds

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Chart 2-1: Inverter Power De-Rating Chart*

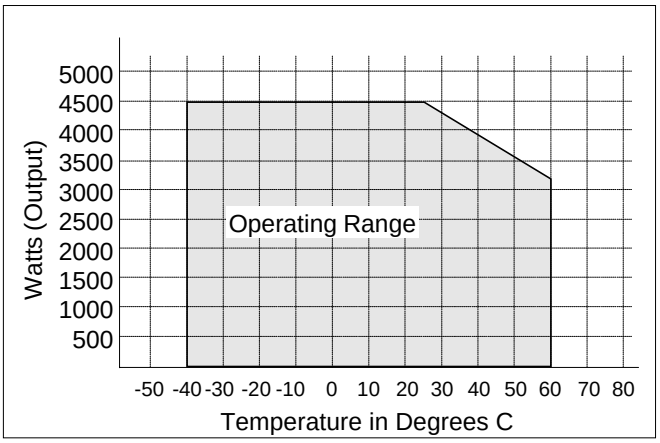
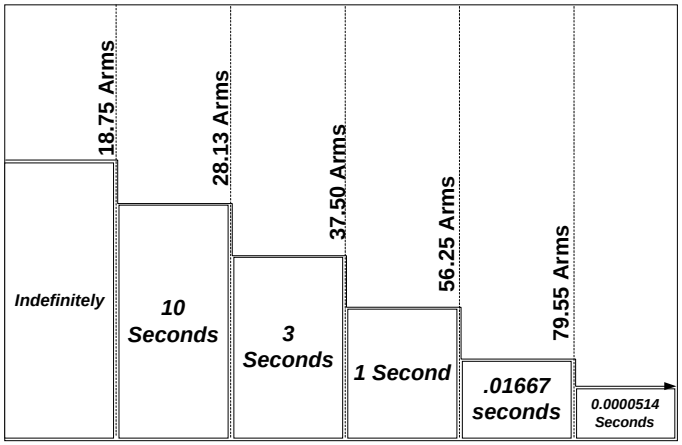


Chart 2-2: Output Current Surge Fault Response Time @ 25°C*



***Note:**	**The RE-4500 Inverter will try to power the load as per the chart above. When the load exceeds the inverter's rated output the Inverter/Charger Indicator LED will turn Orange. The current limit circuit will operate in the manner indicated above, and will reduce the AC Output Voltage as needed to keep the AC Output Current from exceeding specifications. If the output voltage is outside the limits shown in Chart 2-3, the inverter will shut off and the Inverter/Charger LED will turn Red.**

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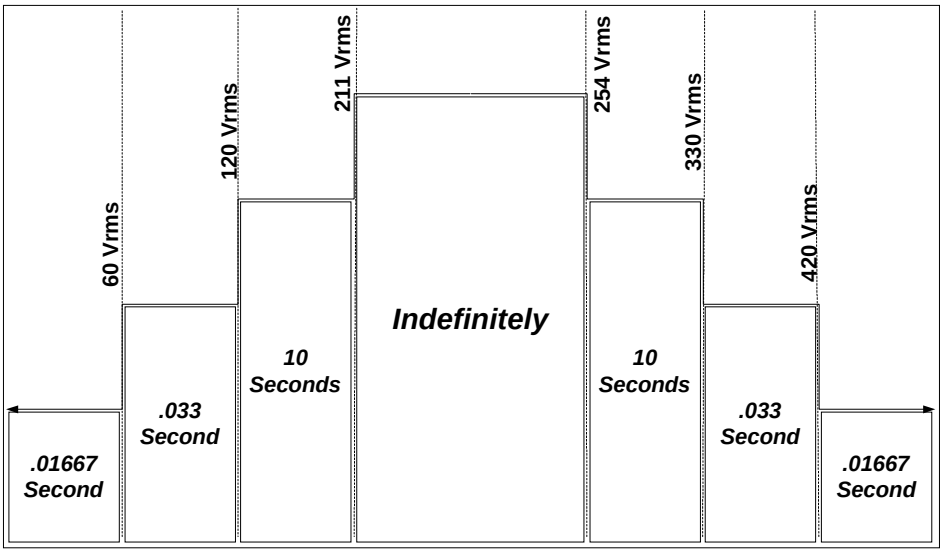
Chart 2-3: Current Regulation (Brownout) Mode Shutdown Time



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Standard Features

- True sine wave single phase 3 wire 240 V_{RMS} output.
- Unity Power Factor Corrected Battery Charger for less AC Input Distortion, accommodating Lead Acid, Flooded-Cell, GEL, and AGM types of batteries.
- True single phase three wire 240V_{RMS} output that can be used with Multiwire branch circuits, without needing the load rewiring (required by many single phase inverters).
- Total harmonic distortion less than 5% for all loads up to the Surge Output Rating.
- Reliable electronic protection designed to handle output short-circuits and output overloads.
- Terminal block for hardwiring the AC outputs.
- Automatic shutoff for low or high battery voltage, overload, or over-temperature.
- Relay Output circuits, providing Normally Open (NO) and Normally Closed (NC) control for activating external devices and alarms.
- Indicator lights for Inverter, Temperature, Battery, Generator, and Utility status.
- Thermostatically controlled cooling fan.

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Parts and Accessories

Part Number	Name	Description
RE-ICC/LCD	Remote Display	Inverter/Charger Controller – changes and displays the programmable settings inside the RE-4500.
RE24-4500S	24V RE-4500 with a Small Inverter Board	This option enables greater efficiency when the inverter is providing power for a light load (less than 75 watts).
RE-ACM	AC Control Module	Includes most requirements for utility, load, bypass, and AC generator connections, breakers, and switches in a convenient assembly.
RE-DCM *Models:* *RE48-DCM* *RE24-DCM*	DC Control Module	Includes most requirements Solar, Battery, Auxiliary DC Loads, Charge Controllers, Disconnects, and connections for the DC source and loads in a convenient assembly.
RE-BTS1	B/T Sensor	Battery Temperature Sensor – an optional sensor available to more accurately monitor the condition of batteries in the system.
RE-SLM *Model:* *RE48-SLM*	Sun Lynx Module	Configures the system for “battery-less operation”. This module is used to connect to the Solar Array instead of the RE-DCM used in a Battery populated system.

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3 Important Safety Instructions

WARNING:	**Before you install and use your RE-SERIES AC Power Inverter, read and save these safety instructions!**

This manual contains important safety and operating instructions for the Vanner Incorporated RE-4500 Power Inverter that shall be followed during installation and maintenance of the inverter as prescribed by Underwriters Laboratories (UL). The RE-4500 inverter is listed as compliant with UL 1741 Power Conditioning Units for use in Residential Photovoltaic Power Systems.

Warning Labels
Please READ ME

It should be noted that hazardous voltages are associated with this product. This unit has connections to both DC at lethal amperages and AC at lethal amperages and voltages.

Installation should only be done by qualified personnel and in compliance with local regulations and codes.

Special care must be taken in working around the RE-4500 Inverter/Charger System in order to avoid hazardous voltages and currents.

NOTE:	**In order to reduce the risk of damage to personnel or equipment, please read all instructions in this manual, particularly warnings noted by the following symbols.**

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These symbols are used to note procedures that if not closely followed could lead to loss of life or damage to equipment or property due to electrocution.

Electrocution hazard exists

Fire hazard exists

A potentially dangerous condition

Explosive hazard exists

Corrosive hazard exists

The following are additional symbols used in identifying other aspects of the RE-4500.

AC

This symbol denotes AC Voltage is potentially present on this termination.

DC Voltage

This symbol denotes DC Voltage is potentially present on this termination.

L1

Phase 1

This symbol denotes that this termination is used for the upper phase of a 240 Vrms 3 wire system consisting of Phase 1 (Black wire), Neutral (White wire), and Phase 2 (Red wire).

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N — **Neutral**

This symbol denotes that this termination is used for the middle wire of a 240 Vrms 3 wire system consisting of Phase 1 (Black wire), Neutral (White wire), and Phase 2 (Red wire).

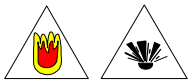
L2 — **Phase 2**

This symbol denotes that this termination is used for the lower phase of a 240 Vrms 3 wire system consisting of Phase 1 (Black wire), Neutral (White wire), and Phase 2 (Red wire).

GND — **Ground**

This symbol denotes that this termination is used for a ground connection (Green wire).

Safety Instructions

	Caution **Read owners manual BEFORE wiring or powering up the RE-4500.**
	Caution **DO NOT cover or obstruct ventilation openings. DO NOT mount in a zero-clearance compartment. Overheating may result.**
	Warning **Under high ambient temperature / high-power-output conditions some parts of the inverter may become hot enough to cause burns. The unit should be installed so that it is not to be contacted by personnel.**
	**Warning** **This equipment employs components that tend to produce arcs and sparks. To prevent fire or explosion, DO NOT install in confined areas or compartments that contain batteries or flammable gases and materials.**
	Warning **Improper use of this product may result in risk of electrical shock. Both AC and DC voltage sources are terminated inside this equipment.**

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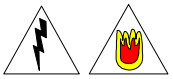
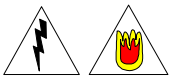
	Battery connections are for disconnection only, NOT for current interruption.

General Precautions

	Do not expose the inverter/charger to direct water spray, rain, or snow.
	To reduce the risk of a fire hazard, do not cover or obstruct the ventilation openings.
	Do not install the inverter in a zero clearance compartment. This may result in overheating and/or diminished performance.
	**To avoid the risk of fire, electrical shock, or injury to persons, do not use attachments not recommended or sold by Vanner Incorporated.**
	Vanner recommends that all AC and DC electrical wiring be performed by a licensed electrician or a qualified technician to ensure compliance with all applicable national and local wiring regulations.
	**To avoid a risk of fire and/or electrical shock, always verify wiring connections are in good electrical condition. All external conductors must use proper wire size to avoid dangerous overheating and/or diminished performance.**
	If the inverter has been dropped or damaged in any way, do not operate the inverter until it has been verified to be safe by a qualified technician.
	To reduce the risk of electrical shock, always disconnect the AC and DC connections using the code required AC and DC disconnects. The On/Off switch only turns off the Inverter electronics. Dangerous AC and DC Voltages Are Still Present!
	The inverter must be properly grounded in accordance with local and national codes and ordinances before operation. For most installations, the negative (ground) conductor should be bonded to the grounding system at one and only one point in the system.
	For optimum inverter/charger performance, battery temperature should be above 32 degrees Fahrenheit.

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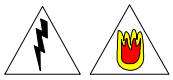
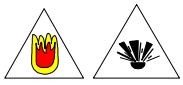
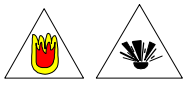
	**Do not disassemble the inverter/charger. See the service section of this manual for instructions on obtaining service. Attempting to service the inverter yourself may result in a risk of electrical shock, fire and/or loss of warranty.**
	Always use service disconnects to break the circuit before attempting any kind of servicing of the RE-4500. DO NOT attempt to service the unit while still actively connected to a power source of any kind.

Explosive Gas Precautions

	**This equipment contains components, which tend to produce arcs or sparks. To prevent fire or explosion, do not install in compartments containing batteries or flammable materials, or in locations that require ignition protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connections between components of the fuel system.**
	**To reduce the risk of battery explosion, follow these instructions, the battery manufacturer instructions, and the instructions of the manufacturer of the equipment in which the battery is installed. Working near a lead-acid battery is dangerous. Batteries generate explosive gases during normal battery operation.**

Battery Precautions

	Always have someone within range of your voice to come to your aid when you work near a lead-acid battery.
	Have close access to plenty of fresh water and soap in case battery acid contacts skin, clothing, or eyes.
	Always wear complete eye protection and clothing protection. Avoid touching eyes while working near batteries.
	If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 20 minutes. Get medical attention immediately.
	NEVER smoke or allow a spark or flame near a battery. Gases produced by batteries are explosive.

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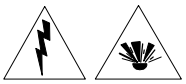
	Be careful when working with metal tools around batteries. Potentials exist for sparks or short-circuit of the battery or other electrical part which could cause an explosion.
	Before attempting any sort of wiring for the DC supply to the Inverter, turnoff the DC disconnect associated with the Batteries. For Safety, ALWAYS check the operation of the disconnect with a voltmeter!
	**In addition to the lethal current associated with the batteries, care must be taken to avoid any potential problems or explosions from the batteries. ALWAYS comply with the battery manufacturer's and local code requirements/guidelines for the installed battery system.**

Code Compliance

Vanner Model RE-4500 is certified by Underwriter's Laboratory to meet UL listing 1741 for Photovoltaic Systems, and complies with IEEE 929 and the National Electric Code Article 690, Solar Photovoltaic Systems.

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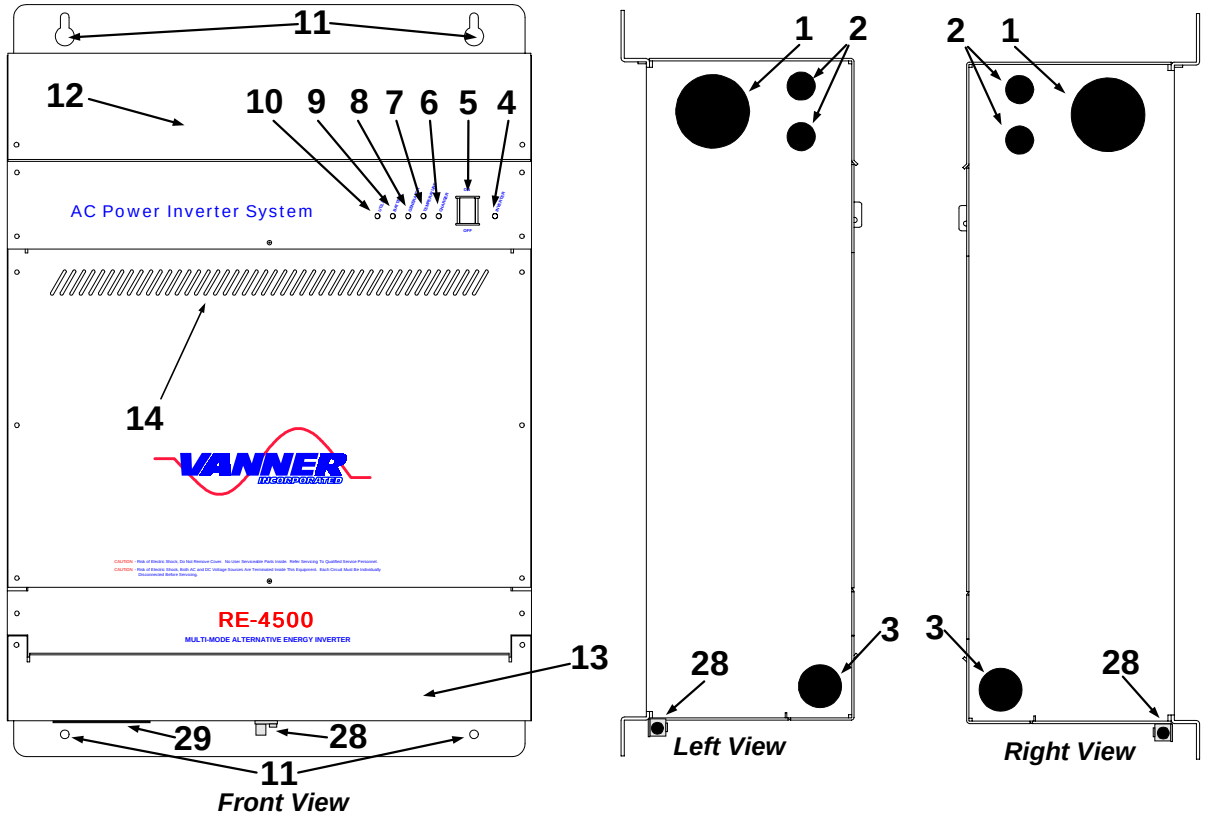
4 Component Identification

This section will give the reader an idea as to location and description of various features of the RE-4500.

Note that at the top of the unit there is a parallel raceway with terminations for connecting DC Power and Control Wiring. The bottom of the unit contains another parallel raceway for AC Power Wiring connections.

Figure 4-1: Inverter/Charger Front and Side View



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(1) Knockout for High Current DC Wiring

This knockout provides for the routing and termination of high capacity DC cables from batteries, RE-SLM, RE-DCM to the RE-4500 Inverter/Charger.

This knockout provides access (from either the right side or the left side of the inverter) to the DC Wiring Raceway.

This knockout matches up with the high capacity DC knockout on Vanner accessories such as the DC Control Module (RE-DCM), the RE48-SLM (Sun Lynx Module), and the AC Control Module (RE-ACM). This is a standard size 2 ½" conduit knockout.

(2) Knockout for Low Current DC Control Wiring

These knockouts provide for the routing and termination of low capacity DC Control Wiring.

These knockouts provide access (from either the right side or the left side of the inverter) to the DC Wiring Raceway.

These knockouts match up with the low current DC/Control knockouts on Vanner accessories such as the DC Control Module (RE-DCM), the RE-SLM (Sun Lynx Module), and the AC Control Module (RE-ACM). This is a standard size ¾" conduit knockout.

(3) Knockout for AC Wiring

This knockout provides for the routing and termination of AC Wiring.

This knockout provides access (from either the right side or the left side of the inverter) to the AC Wiring Raceway.

This knockout matches up with the AC knockout on Vanner accessories such as the AC Control Module (RE24-ACM), the RE48-SLM (Sun Lynx Module), and the DC Control Module (RE24-DCM). This is a standard size 1 ¼ " conduit knockout.

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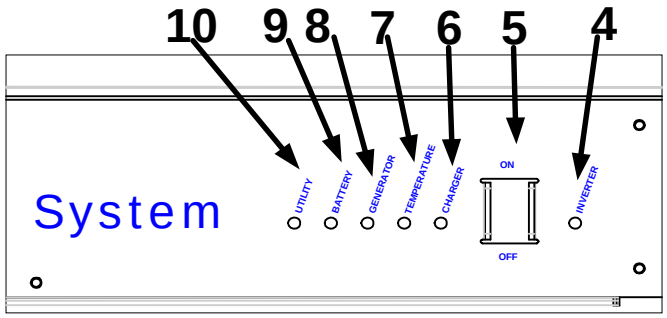
Figure 4-2: Inverter/Charger Front Panel Indicators



(4) Inverter LED

	Off	The RE-4500 is not inverting, however, if all of the other front panel indicators are also off, then the RE-4500 is OFF.
	Green	The RE-4500 is Inverting, Charging or Grid Interactive. If blinking, it is Inverting and in "Load Demand."
	Orange	The RE-4500 is Inverting and in "brownout" and/or is constantly supplying its maximum current. If the system is in "Charging" mode and this LED is orange, the charger is supplying its maximum current.
	Red	The RE-4500 has shutdown due to a "brownout" Condition.

(5) ON/OFF Switch (and RESET Switch)

The ON/OFF Switch is a two-position switch used to turn the inverter electronics ON and OFF. This ON/OFF switch can also be used to RESET any faults that might be present.

These faults are displayed on the Indicator LEDs and in the ALARM Menu of the optional Inverter. These faults will be displayed until the Inverter is RESET by turning it "OFF" and then back "ON".

If the fault is serious enough, the inverter will automatically shut itself OFF. Likewise, the inverter can be RESET by turning the ON/OFF Switch "OFF", and then back "ON".

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(6) Charging LED

Off	The RE-4500 is not CHARGING or in a GRID-INTERACTIVE mode or they both have been turned OFF.
Green	The RE-4500 is CHARGING or in a GRID-INTERACTIVE mode.
Orange	Unused.
Red	Unused.

(7) Temperature LED

Off	This should never happen when the inverter is on. The LED is burned-out.
Green	The RE-4500's internal temperature is between -40 and +35 °C.
Orange	The RE-4500 is operating at a temperature above +35°C. The fan is on, its internal temperature is above 35 °C, or the "Brick" or Small Inverter temperature is above 75 °C.
Red	The RE-4500 has shutdown due to over temperature. The fan is FULLY on, its internal temperature is above 60°C, or the "Brick" or the Small Inverter temperature is above 90°C or the Large Inverter Transformer temperature is above 75°C.

(8) Generator LED

Off	The Generator Start option is OFF or the relay has NOT been engaged.
Green	The RE-4500 has engaged the Generator Start Relay, Grid AC is present, and CHARGING is underway.
Orange	The RE-4500 is trying to Charge, but a good Grid voltage is not present. The relay is ON, but will go OFF after 90 S (Factory setting).
Red	The RE-4500 is trying to Charge, but a good Grid voltage is not present. The relay is OFF.

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(9) Battery LED

	Off	Should only happen when the RE-4500 is turned off.
	Green	The Battery Voltage is Good. (Between 22 and 31 VDC / Factory settings).
	Orange	The Battery Voltage is above the Low Battery Shutdown value (Factory setting 21 VDC), but it is below the Low Battery Warning value (Factory setting / 22 VDC). The Low Battery Warning relay is ON.
	Red	The RE-4500 has shutdown because either the Battery Voltage is above the High Battery Shutdown value (Factory setting 31 VDC) or is below the Low Battery Shutdown value (Factory setting / 21 VDC). If the latter case is true, then the Low Battery Warning relay is ON or the battery is "dead."

(10) Utility LED

	Off	The Inverter is OFF.
	Green	The RE-4500 is attached to the Grid. The Grid frequency and voltage are within preset limits, and the transfer relay is engaged. The inverter is in either BYPASS, CHARGING, or GRID-INTERACTIVE modes.
	Orange	The RE-4500 is waiting to phase-lock. The Grid frequency and voltage are both within preset limits. When the AC good timeout has expired (Factory setting 90 S) then the bypass relay will engage and the LED will turn green.
	Red	An unacceptable grid condition is present. The voltage, the frequency, or both are outside acceptable limits.

(11) Mounting Bolt Slots

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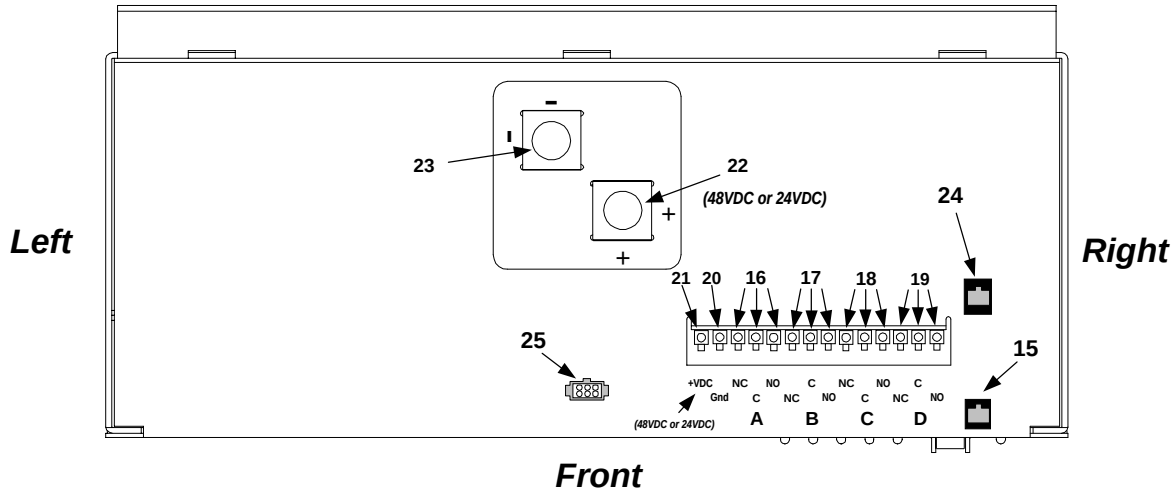
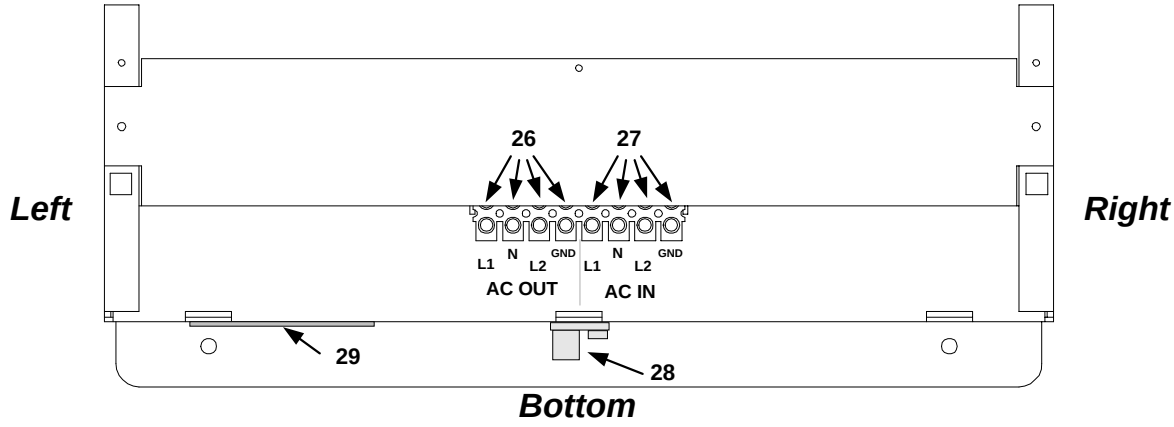
(12) Access Cover for DC Raceway

Figure 4-3: DC Raceway Terminations



(13) Access Cover for AC Raceway

Figure 4-4: AC Raceway Terminations



(14) Air Intake Vents

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(15) Battery Temperature Sensor Monitor Port

At this time, this is an option on 24 Volt systems only!

This RJ11 Port enables battery bank temperature monitoring with the optional Vanner Battery Temperature Sensor (Vanner Part Number RE-BTS1). This sensor is used for optimizing battery charging efficiency, extending battery life, and battery fault monitoring.

Warning

This connector is for the Battery Temperature Sensor Only! Attaching any other device to this connector can result in loss of life, damage to the system, and voiding of your manufacturers warranty.

Check your terminations carefully!

(16) Relay A Contacts – Low Batt

These terminals are available to the user from the RE-4500 and can be used for several programmable functions. These functions are listed in Table 4-1: Relay Configurations for Relay A. The Factory Setting for this set of contacts is for Low Battery Alarm. These three Terminals are designated as Normally Open, Common, and Normally Closed.

Table 4-1: Relay Configurations for Relay A

Function	Configuration	Comments
Low Battery Alarm	Form C	Factory Setting

(17) Relay B Contacts

These terminals are available to the user from the RE-4500 and can be used for several programmable functions. These functions are listed in Table 4-2: Relay Configurations for Relay B. There is no assigned condition for this set of contacts at this time. These three Terminals are designated as Normally Open, Common, and Normally Closed.

Table 4-2: Relay Configurations for Relay B

Function	Configuration	Comments
Not Assigned	Form C	

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(18) Relay C Contacts – Gen. Start

These terminals are available to the user from the RE-4500 and can be used for several programmable functions. These functions are listed in Table 4-3: Relay Configurations for Relay C. The Factory Setting function for this set of contacts is **Generator Start**. These three Terminals are designated as Normally Open, Common, and Normally Closed.

Table 4-3: Relay Configurations for Relay C

Function	Configuration	Comments
Generator Start	Form C	Factory Default

(19) Relay D Contacts

These terminals are available to the user from the RE-4500 and can be used for several programmable functions. These functions are listed in Table 4-4: Relay Configurations for Relay D. There is no Factory Setting function for this set of contacts. These three Terminals are designated as Normally Open, Common, and Normally Closed.

Table 4-4: Relay Configurations for Relay D

Function	Configuration	Comments
Not assigned	Form C	

(20) Control Relay Ground Terminal

This terminal supplies 24VDC Ground for use in powering relays in the RE24-4500 Inverter system.

(21) Control Relay Auxiliary VDC Output Terminal

In the RE24-4500, this terminal supplies 24VDC (current limited to 1 Amp) for use in wetting 24VDC relays contacts. In the RE48-4500 this terminal provides 48VDC for use in wetting 48VDC contacts.

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(22) Positive Termination From DC Power Source

Attach either +24 VDC or 48 VDC (depending on your model) Positive feed to this terminal

Warning

Check Polarity Carefully! Attaching the Negative supply to this terminal can result in loss of life, damage to the system, the batteries, and voiding of Warranty.

Check your terminations carefully!

!!Make Certain that the proper voltage is connected to the unit – 24VDC for the RE24-4500, and 48VDC for the RE48-4500. Damage will result if improper voltage is applied.

(23) Negative Termination From DC Power Source

Attach either +24 VDC or 48 VDC (depending on your model) Negative (Ground) feed to this terminal.

Warning

This terminal is grounded to the inverter Chassis

Check Polarity Carefully! Attaching the Positive supply to this terminal can result in loss of life, damage to the system, the batteries, and voiding of Warranty.

Check your terminations carefully!

(24) Serial Control Connector

This RJ-11 jack is for serial communication between the RE-4500 and the remote display (Inverter / Charger Controller) – Vanner Part RE-ICC or RS-232 Control/Programming Cable.

Alternately this connector can be used to communicate with a computer using RE-ICC For Windows using the Vanner provided communications cable which comes with ICC for Windows.

Warning

This connector is for the RE-ICC Remote Display or the Vanner Serial Communications cable! Attaching any other device to this connector can result in loss of life, damage to the system, and voiding of the manufacturers Warranty.

Check your terminations carefully!

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(25) Option Connector

This connector is supplied to support the Generator Option in the Vanner AC Control Module (RE-ACM) please review the manual supplied with the RE-ACM unit for more information.

(26) AC Output Terminations

Terminations for the Load to be connected to the RE-4500 are connected to the proper terminals: L1 is Phase 1, N is Neutral, and L2 is Phase 2 of a split phase system.

Warning

Check Polarity Carefully! Improper wiring of these terminations can result in loss of life, damage to this system, damage to connected loads, and voiding of Warranty.

Check your terminations carefully!

(27) AC Input Terminations

Terminations for the Utility to be connected to the RE-4500 are connected to the proper terminals: L1 is Phase 1, N is Neutral, L2 is Phase 2, and GND is Chassis Ground for the split phase Grid connection.

Warning

Check Polarity Carefully! Improper wiring of these terminations can result in loss of life, damage to this system, damage to connected loads, and voiding of Warranty.

Check your terminations carefully!

Note

The Output Neutral is <u>not</u> bonded to Ground at the Inverter.

(28) Chassis Ground Bonding Lug

The Chassis Ground Bonding Lug is used to create a tie point for connecting the Chassis of the RE-4500 to ground.

(29) Cooling Fan

The cooling air exhaust fan is located on the Bottom of the inverter. Air is brought in through the front cooling slots as well as the rear plenum and exhausted at the bottom of the

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inverter. Always allow a minimum of 12” clearance (30.48 cm) below the Inverter to insure proper cooling.

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5 System Operation Description

This section of the Owner's manual will cover command and control of the system, and also describe the different components that make up the RE-4500.

The RE-4500 is an Inverter/Charger system that has the capability of drawing power from the grid or selling excess power back to the grid, and creating split-phase 240 VAC from a nominal 24 VDC source (RE24-4500), or a nominal 48VDC source (RE48-4500). This DC source can consist of both Photovoltaic Modules and lead acid batteries of Flooded Cell, Gel Cell, or AGM types.

Warning

It is important not to mix types of batteries in a string. Mixing different types of batteries could result in death, explosion, or fire, which would damage equipment and void the warranty.

The RE-4500 also has the capability of charging the battery bank from the grid itself, in the event that solar power is not available and the batteries are discharged.

Figure 5-1: Block Diagram shows the components of the RE-4500.

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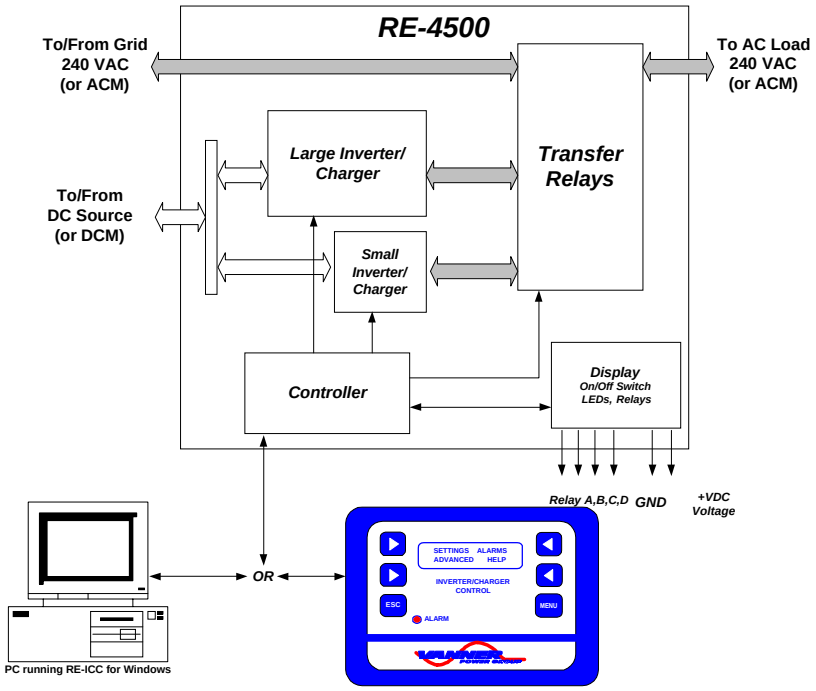
Figure 5-1: Block Diagram



The components that make up the RE are:

- **System Controller Board**

  The System Controller is the brain of the system that monitors and controls the operations of the system. It receives commands from the user entered on the RE-ICC, and executes those commands to control the system. It controls all system operations: Inverting, Charging, Grid-Tie, and Generator Control.

- **Large Inverter/Charger**

  The Large Inverter/Charger is responsible for converting the DC Voltage from the batteries and the photo-voltaic modules to split phase, 240 VAC. When in “Charger” mode, if the batteries are low, this component will convert the 240VAC from the Grid to the DC Voltage (either 24VDC or 48VDC, depending on the system) to charge the batteries if they are low. The Large Inverter/Charger is used by the system if the power required by the load is in the range of 75 to 4500 watts.

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- **Small Inverter**

  This Small Inverter is responsible for converting the DC Voltage from the batteries and photovoltaic modules to split phase, 240 VAC. The Small Inverter/Charger is used by the system if the power required by the load is from 0 (zero) to 75 watts. The Small Inverter/Charger is used for improving the efficiency of the system under light loads.

- **Transfer Relays**

  The Transfer Relays are responsible for connecting the:

  - Grid to the Load
  - Small Inverter to the Load
  - Large Inverter to the Load

  All of these configurations are under direct control of the System Controller

- **Display board**

  The Display board displays system status of the:

  - Inverter
  - Charger
  - Temperature
  - Generator
  - Battery
  - Utility

  The Display board also provides relay contacts (Normally Open, Normally Closed, Common, current limited VDC (determined by system voltage), and Ground) for various configured purposes (Generator Start, Low Battery Warning, etc).

- **Inverter/Charger Control**

  The Inverter/Charger Controller (RE-ICC/LCD or RE-ICC/VFD) and RE-ICC for Windows provide an intelligent user interface for configuring, commanding, and getting status from the RE-4500. The RE-ICC uses a menu based system for these functions which is described in the Inverter Charger Controller section on page 5-13.

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RE_ICC for Windows is a Windows based program that supports a Windows type Graphical User Interface for displaying, controlling, configuring, and upgrading software relating to the operation of the RE-4500. Its' primary purpose is to assist the installer in the configuration, field setup and maintenance of the RE-4500 system. For more information on RE-ICC for Windows, please refer to the RE-ICC for Windows Operations Manual.

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Modes of Operation

The RE-4500 operates in three modes:

- Inverting
- Charging
- Grid-interactive

This section will describe these and any sub-modes within them, and their respective faults.

The RE-4500 is designed so that if there is a fault the RE-4500 will shutdown. If the fault condition goes away, the inverter will restart after 5 minutes in “Auto Recovery” mode.

The next Sections will describe these three modes of operation.

Inverting

When the grid is not available and the batteries have enough charge then the RE-4500 generates AC power. The 240 V_{RMS} three-wire output will deliver a continuous 18.75 A_{RMS} @ 25°C. Also, if Charging is not enabled and AC Power is present, then the inverter will run phase-locked to the Grid.

Load Demand (Load Discover)

The inverter does “load demand” to improve efficiency when the small inverter is not installed and the option is enabled. The default settings are “Load Demand: ON” and 10 W to enter load demand (start pulsing) and 75 W to leave load demand (generate a constant voltage). When the load falls below 10 W there will be a 5-second delay (default setting) before pulsing begins.

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Small Inverting

The inverter uses the small inverter when it is installed and the option is enabled to improve efficiency. The default settings are “Load Demand: ON” and 10 W to use the small inverter and 75 W to switch to the large inverter. When the load falls below 10 W there will be a 5-second delay (default setting) before switching.

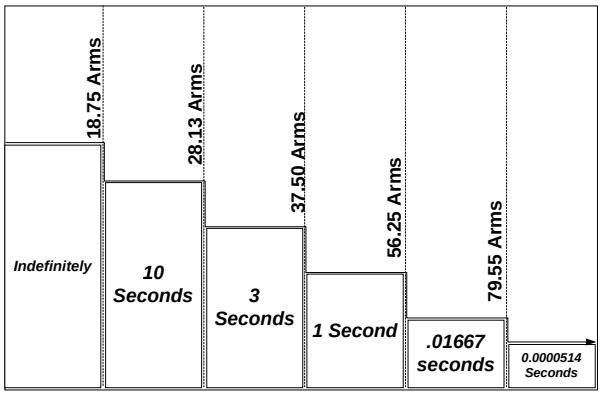
Normal Inverting

“Normal Inverting” is defined as inverting when the load current is below the maximum (default setting) of 18.75 A_{RMS}. The inverter generates a constant voltage. 120 V_{RMS} is the default L1 to Neutral setting. If the current rises above 18.75 $A_{RMS,}$ then the inverter starts surging.

Surging

“Surging” occurs when the load current is above (default setting) of 18.75 A_{RMS}. For three seconds the inverter attempts to generate a constant voltage at its default voltage setting. The inverter will respond and shut down (depending on the load) as shown in the diagram below.

Chart 5-1: Output Current Surge Fault Response Time @ 25ºC*



Browning Out

“Brown out” occurs when the load current matches exactly the (default setting) of 18.75 A_{RMS}. The inverter will supply a constant current while the output voltage falls. If it falls

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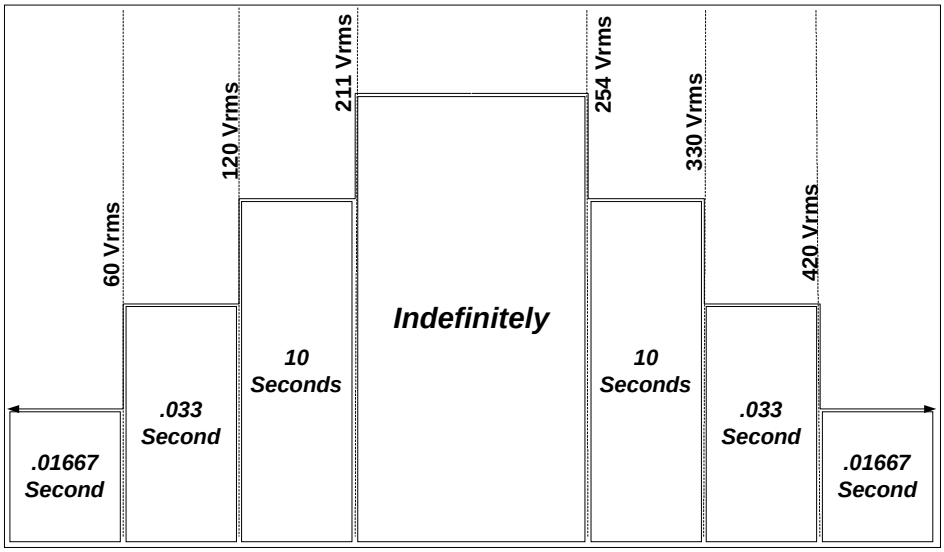
sufficiently, as shown in the chart below, the inverter will shutdown.

Chart 5-1: Current Regulation (Brownout) Mode Shutdown Time



Low Battery Shutdown

There are two cases that will trigger a low battery shutdown. In one case, there is no AC present to charge the batteries and in the other, charging is disabled. When a low battery shutdown occurs the inverter will not restart until the battery voltage rises above the Battery shutdown voltage.

The assumption is that there is another source for battery charging. This avoids cycling the inverter Off and On and possibly harming the batteries when they are discharged.

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Charging

When the battery voltage falls below the DC Warning level (default setting / 22 V_{DC} for RE24-4500, ***44 V_{DC}*** for the RE48-4500), power is taken from the grid and used to fully charge the batteries starting with Bulk charging. The RE-4500 will charge the batteries at unity power factor using the full VA rating of the charger.

The RE-4500 is capable of a maximum charging current of 100A_{DC}.

There are several types of charging modes used by the RE-4500 listed below: It should be noted that the numbers for the below examples are listed for a 24 Volt RE24-4500 with the numbers for the RE48-4500 in parentheses and ***Bold italics***.

- **Bulk**

  During Bulk charging the system first presents a constant DC current to the battery while watching for the Bulk voltage end limit. The defaults are 100 A_{DC} and 28.4 V_{DC} respectively (***50 A_{DC} and 56.8 V_{DC}*** for the RE48). Next, the system holds the battery at the Bulk voltage 28.4 V_{DC} (***56.8 V_{DC}*** for 48V_{DC}) while watching for the DC current to drop to the Absorption current of 10 A_{DC} (***56.8 V_{DC}***). Then the system does Absorption charging.

- **Absorption**

  Absorption charging is a constant current charging mode with a time out. The system again begins by directing a constant DC current into the battery (up to 50 A_{DC} (***25 A_{DC}***)) while watching for the Absorption voltage limit of 30 V_{DC} (***60V_{DC}***). If either of these limits are hit (or 15 minutes passes), then the system switches to Float charging.

- **Float**

  Float charging is a constant voltage charging mode with a current limit. The factory setting is 26.4 V_{DC} (***56.8 V_{DC}***). If the Absorption current limit is hit 50 A_{DC} (***25 A_{DC}***), then the system resumes Bulk charging.

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- **Equalize**

  Equalize charging is the only charge mode that the RE-4500 does not enter automatically. During Float charging, the user turns on Equalize charging with the RE-ICC remote. Equalize charging is another constant current charging mode with a time out. The system again directs the constant DC Absorption current (10 A_{DC} for $24V_{DC}$, ***-5 A_{DC} for 48V_{DC}***) into the battery while monitoring the Absorption voltage limit of 31 V_{DC} (***62 V_{DC}***). Once the limit is encountered or 15 minutes has passed, the system either continues or begins Float charging.

Battery Temperature Sensor

A user-installed option is an external, battery temperature sensor. It provides for battery overheat detection (default 120 °F), and battery voltage temperature compensation during charging. The following section describes how the "Battery Temperature Compensation for Charging" feature works.

- The default setting is 3.6 mV_{DC} / °C. The factory setting for this option is "OFF." It may be turned "On" with the RE-ICC remote.
- The compensation value only affects the charging voltages when the battery temperature is above 77 °F. This is a safety feature to avoid applying excessive battery voltage when battery temperatures are low.
- The compensation value affects each of the battery Float, Bulk, Absorption and Equalization values, and charging modes. For example if the Float battery setting is 26.0 V_{DC}, and the battery temperature is 107 °F, and the battery temperature coefficient is -10 mV / °F then the float value used by the software will be 26.0 V_{DC} - {10 mV / °F × (107° F - 77 °F) × 12 cells} = 22.4 $V_{DC.}$
- The default setting for "High Battery Temperature" shutdown is 140°F (60°C). This setting is the upper limit of battery temperature compensation.

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Generator Start Option

This is how the “Generator Start” option for the inverter works:

- If the option is “ON”, the generator start relay is activated when the battery voltage falls below the “Low Battery Threshold” level. “Low Battery Threshold” is settable from the RE-ICC remote.
- The RE-4500 looks at the Bulk charge current 4 minutes (default) after switching on the relay if the AC input is good and the system is charging.
- The relay is switched off after the Bulk charge current has fallen below a current threshold value for 4 minutes (default). Once again, the “current threshold” is settable from the RE-ICC remote.
- The factory settings for “Low battery threshold” and “current threshold” are 22.5 V_{DC} and 5 A_{DC} respectively for the RE24-4500 system. For a 48VDC system the factory settings “Low battery threshold” and “current threshold” are 44V_{DC} and 2.5 A_{DC} This option is factory set to “ON.”

The relay is used ***only*** with a 2-wire generator start.

In order for the Generator Start function to work, the menu item "Generator Strt" has to be “ON”.

Generator Start (when selected) is triggered by leaving the first charging stage. The factory setting for the trigger type of the first charger stage (named "STRT") is "<DC Voltage." This value's factory setting ("Trigger Setting") is 22.00 Vdc for the RE24-4500, or 44 Vdc for the RE48-4500. This means that the generator start relay fires when the battery voltage is less than this threshold.

There also is a setting for "Generator Wait" which is the time the inverter waits for the AC input (generator or Grid) to become valid. This means the following conditions need to be met:

- good L1-to-N and L2-to-N grid voltages
- good frequency
- phase-locked.

The factory setting for "Generator Wait" is 95 Seconds.

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If the AC input is still bad after 95 Seconds, the generator relay is opened and the RE-4500 waits for the "Gen Retry Dly" period of 5 minutes before trying again. This sequence will cycle continuously as long as the battery voltage is low and the grid is bad.

If the AC input is good, then the inverter/charger will progress through its charging stages using the generator until it reaches the last one. The factory (or default) setting for charging stages is 7 so the last one is the 7th. The 7th stage is named "END," and is a float setting. When the software reaches this last stage called "END", the relay is opened thereby stopping the generator. The generator won't restart until the battery voltage falls to less than the battery minimum threshold again.

Grid Interactive

This mode provides power from the RE-4500 in parallel with a second source of power such as the utility or a generator. When paralleling the utility, the purpose is to sell any excess power or to limit the peak current consumption. When paralleling a generator, the purpose is to “stiffen” the AC bus, to provide peak power that the generator alone is not capable of providing.

Note:	**Strict limits from Sandia National Laboratories are used during Grid Interactive Mode - Surplus Power. User settings are ignored.**

Surplus Power

In this mode the RE-4500 regulates the batteries to their Float level. Surplus power is directed to the Grid. The implication is that another source of power such as a Photovoltaic array is delivering more current into the battery than is required to maintain a charge. **Note:** Replaces Vanner’s “Solar Mode.”

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Generator Support

This is an extension of Vanner's Automatic Power Management feature. The default setting is 5 A_{RMS}. In this mode the RE-4500 "backs up" the power source to provide peak power capability or "load leveling." This may be to limit the peak utility power draw or to provide a surge capability that is greater than the other source can provide on its own. In this mode the inverter monitors the input RMS current, and when it exceeds the set value, first, stops consuming power (charging) and second, begins providing power from the battery into the load.

Generator Start and Grid-Interactive

Many generators have poor voltage and frequency regulation. The RE-4500 can be setup to operate with the wider regulation that is sometimes required, but only when the inverter is not connected to the grid. In cases where it is desirable to be connected to the grid and also have generator backup, the tighter voltage and frequency settings must be used. These settings are password protected and can only be set by an authorized installer.

Set Current

The system controller tells the RE-4500 to supply a constant RMS current to the Grid. This is done until the battery reaches its "Low Battery Warning" level, at which point Charging begins. Charging will continue unless the system controller changes the setting. The required trip points are used.

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Bypass

If Charging, Grid-tie, and Inverting are enabled, and if a valid AC source is present, then the transfer relay will be set after the generator delay so that AC power flows to the output from the Grid. If the Grid goes away, Inverting will immediately start. In this mode, the Inverter acts to backup the utility. User settings on voltage and frequency are used.

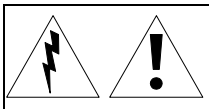
If Charging, Grid-tie, and Inverting are disabled and if a valid AC source is present, then the transfer relay will be set after the generator delay so that AC power flows to the output from the Grid. If the load current goes above the maximum setting, the relay will open. User settings on voltage, maximum current, and frequency are used.

System Control

This section describes the Control of the RE-4500. The controls consist of an On/Off switch and the Inverter/Charger Controller (RE-ICC).

On/Off Switch

The On/Off switch located on the front panel, turns on and off the internal logic power supply. This switch also when placed in the “Off” position resets the system.



Warning

It should be noted that dangerous voltages are still present inside the RE-4500.

Disconnect all DC and AC Power Sources from the RE-4500 before attempting any service of the unit.

There are no User Serviceable Components inside the RE-4500!!

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Inverter Charger Control

This section describes the different methods for controlling and configuring the RE-4500. There are two methods at this time.

1. Inverter/Charger Controller
2. RE-ICC for Windows

The Inverter/Charger Controller is a handheld remote that allows field display and configuration of parameters related to the operation of the RE-4500. The ICC is connected to the Inverter Serial Control Connector.

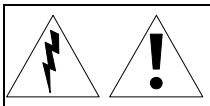
RE-ICC for Windows is a Windows based program that supports a Windows type Graphical User Interface for displaying, controlling, configuring, and upgrading software relating to the operation of the RE-4500. Its' primary purpose is to assist an installer in the configuration and field setup of the RE4500. The RE-ICC for Windows operation is not covered in this document. For more information on RE-ICC for Windows, please refer to the RE-ICC for Windows Operations Manual.

Inverter/Charger Controller

This section describes the operation of the Inverter/Charger Controller which is shown in Figure 5-1: Inverter/Charger Controller. The RE-ICC is used to communicate commands and to monitor the status of the RE-4500. It enables the user to control the system from a number of menus that control different aspects of the RE-4500's operation.

Warning

The Factory Default Settings the unit is shipped with should only be changed by a Vanner Certified Installer or by Authorized Factory Personnel. There are no field adjustable Trip Points. All of these Trip points are password protected to avoid incorrect entries.



Warning

Wrong settings can damage the unit, and lead to personal injury or death, and voiding of the manufacturers warranty.

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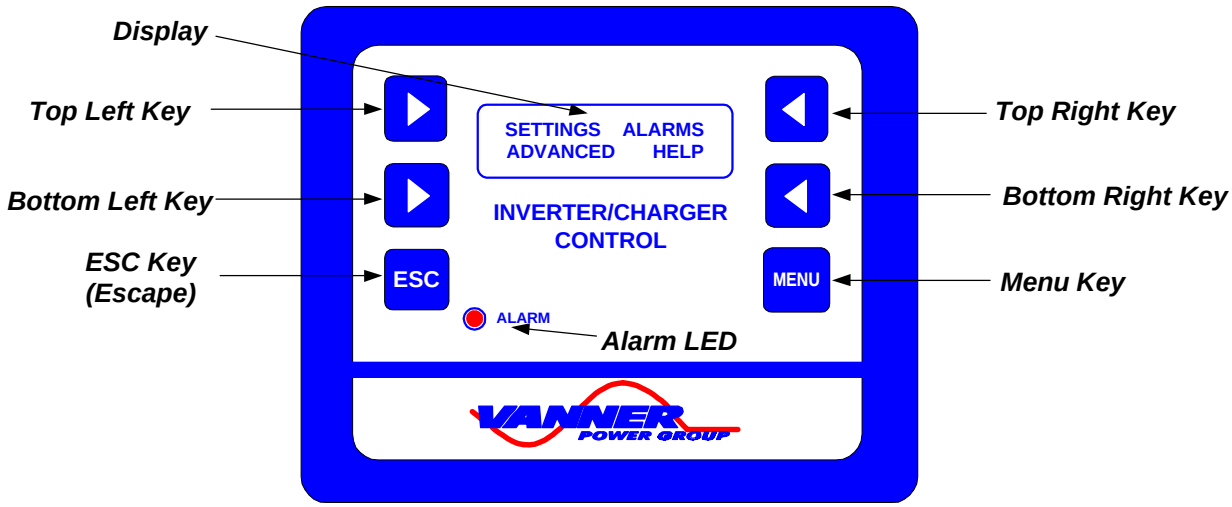
Figure 5-1: Inverter/Charger Controller



Display and Key Functions

The features and functions of the RE-ICC are:

- **Display**

  Used to display Menu selections, Data Entry Fields, Status Messages

- **Top Left Key**

  Selection of menu items or scrolling up through the menu

- **Bottom Left Key**

  Selecting a displayed item, increasing (Incrementing) display items, Selecting an “ON” or “YES” function

- **ESC Key**

  ESC (Escape) key is used to “back up” to the next higher menu and/or to cancel new data being entered.

- **Top Right Key**

  Selection of menu items or scrolling down through the menu

- **Bottom Right Key**

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Selecting a displayed item, decreasing (decrementing) display items, selecting an "OFF" or "NO" function.

- **Menu Key**

  If a Menu is available for a displayed item, this key when depressed moves the display to the new menu.

An additional feature of the **LCD** (**L**iquid **C**rystal **D**isplay) version of the RE-ICC is a contrast control. By holding down the **ESC** key and pressing either the **Top Right Key** (to make the display lighter) or the **Bottom Right Key** (to make the display darker), the contrast can be adjusted.

Note:	**This adjustment for the contrast only works with the LCD type display! The VFD (Vacuum Fluorescent Display) is unaffected by this control.**

Moving Around the RE-ICC Menus

First, "*Don't Panic*"!

Moving around the Inverter/Charger Controller can be a little difficult at first, but with a little practice, it will become very easy! This section contains examples to help the first time user figure out how to enter data and move around the menus.

WARNING:

This Section contains examples to help the user get started with the RE-4500 system. It is assumed that the Inverter has been properly installed at this point. If the RE-4500 has not been installed, have a qualified (Vanner Certified) installer perform the installation of the RE-4500 before proceeding.

Note:	**The example settings shown below are for the RE24-4500. The settings for the RE48-4500 are designated by (*Bold Italics in Parentheses*)**

The RE-ICC Menus consist of the following Menus:

Main Menu	Root Menu, this is the start menu from which everything can be accessed.
Display Menu	Displays status, voltages, current, frequency, etc.

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Settings Menu	Turns Options On / Off and adjusts functional parameters for the RE-4500– mostly used for installation.
Advanced Menu	Adjusts more advanced features dealing with communication, calibration, debugging, in addition to providing password protection levels.
Help Menu	Gives Version level, Help, and Index menus.
Alarm Menu	Displays status messages and automatically scrolls through the listing of active alarms. See Appendix B: RE-ICC Menus.

Turning The Inverter / Charger On and Off

The first procedure we will do is to walk you through the startup of the Inverter/Charger.

Note:	**The Up and Down arrows are actually meant to mean any of the 4 upper buttons on the RE-ICC.**

1. First press ESC. The Display will change to

   SETTINGS ALARMS
   ADVANCED HELP

2. Press the Top Left Key (Next to SETTINGS). The Display will change to

   ↑Inverter ↓
   on OFF

3. Press the Lower Left Key. This will turn the Inverter On. The Display will change to

   ↑Inverter ↓
   ON off

4. Press the Lower Right Key (this will turn the Inverter Off). The Display will change to

   ↑Inverter ↓
   on OFF

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CONGRATULATIONS!! You have turned the Inverter on and off with the RE-ICC!

Next, we will acquaint you with the Menus!

Menu Functions

This section will describe the operation of moving around the Menus of the RE-ICC.

See Figure 5-1: RE-ICC Menus. This is a layout of the RE-ICC Menus. You will see that you have already moved into a sub menu by getting to the Inverter Control Screen!

This section will help you navigate through the different menus associated with the RE-4500.

Don't Worry! You can Escape to where you came from by simply pressing ESC.

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Figure 5-1: RE-ICC Menus

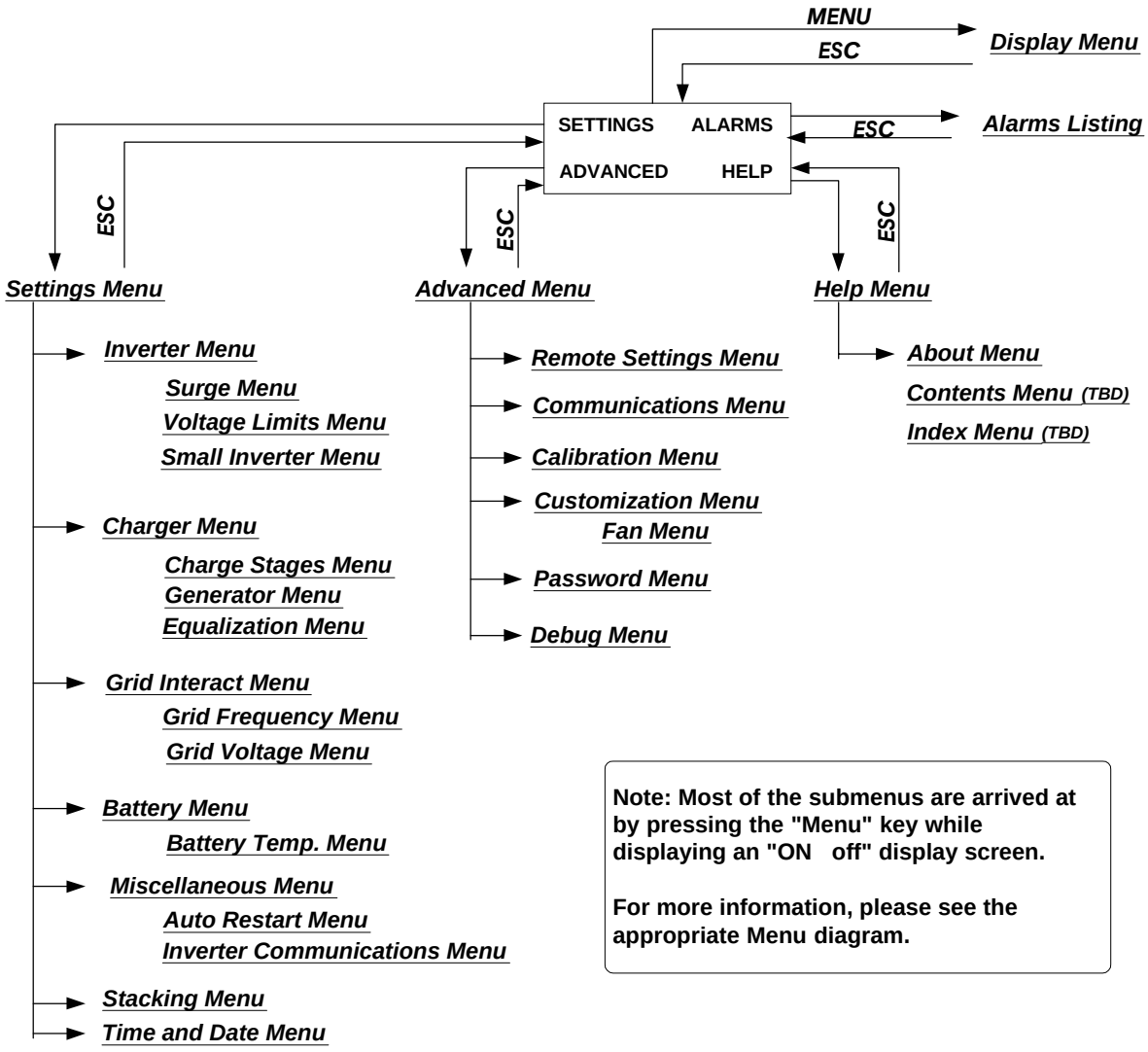

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Figure 5-2: Main Menu

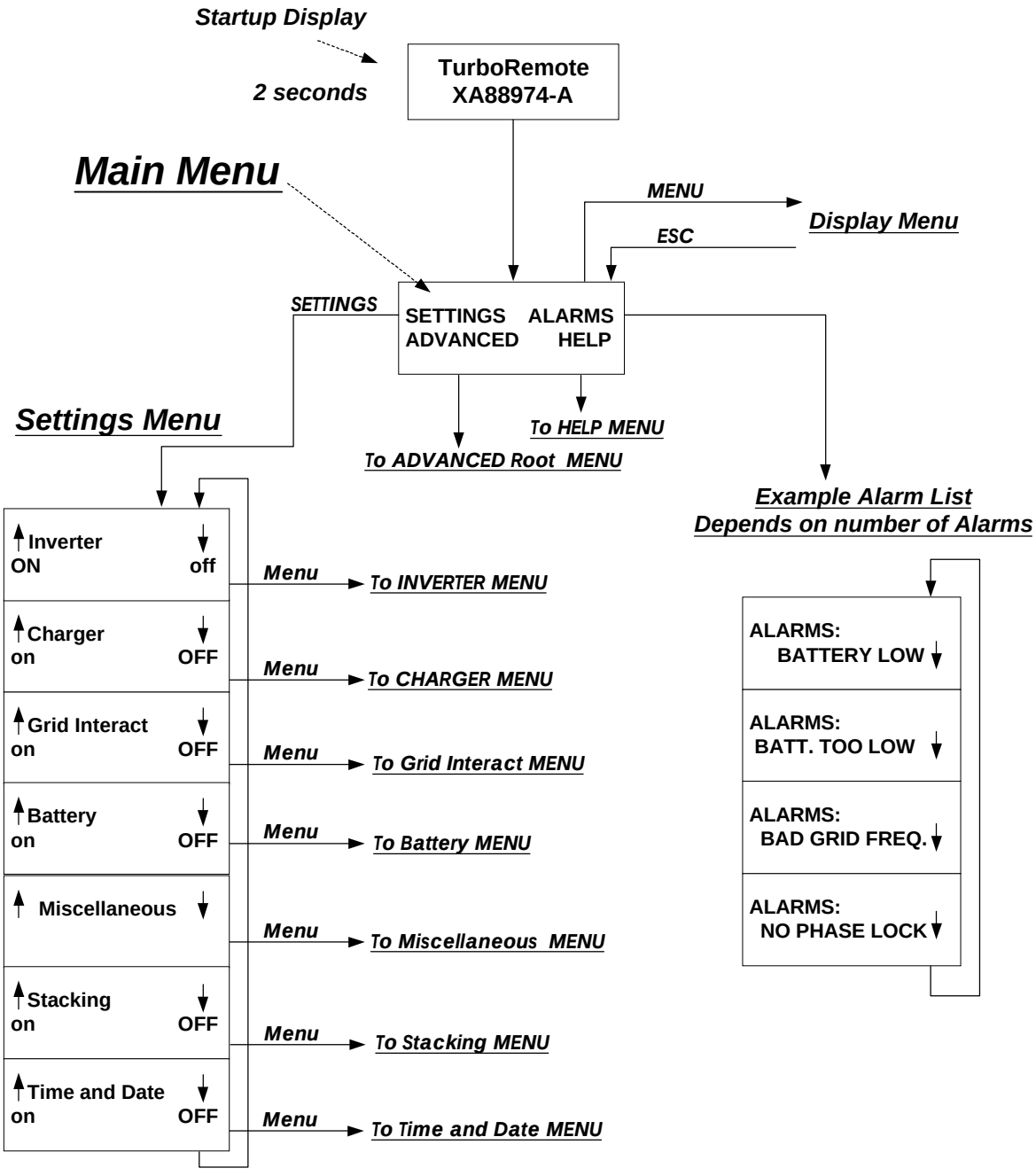

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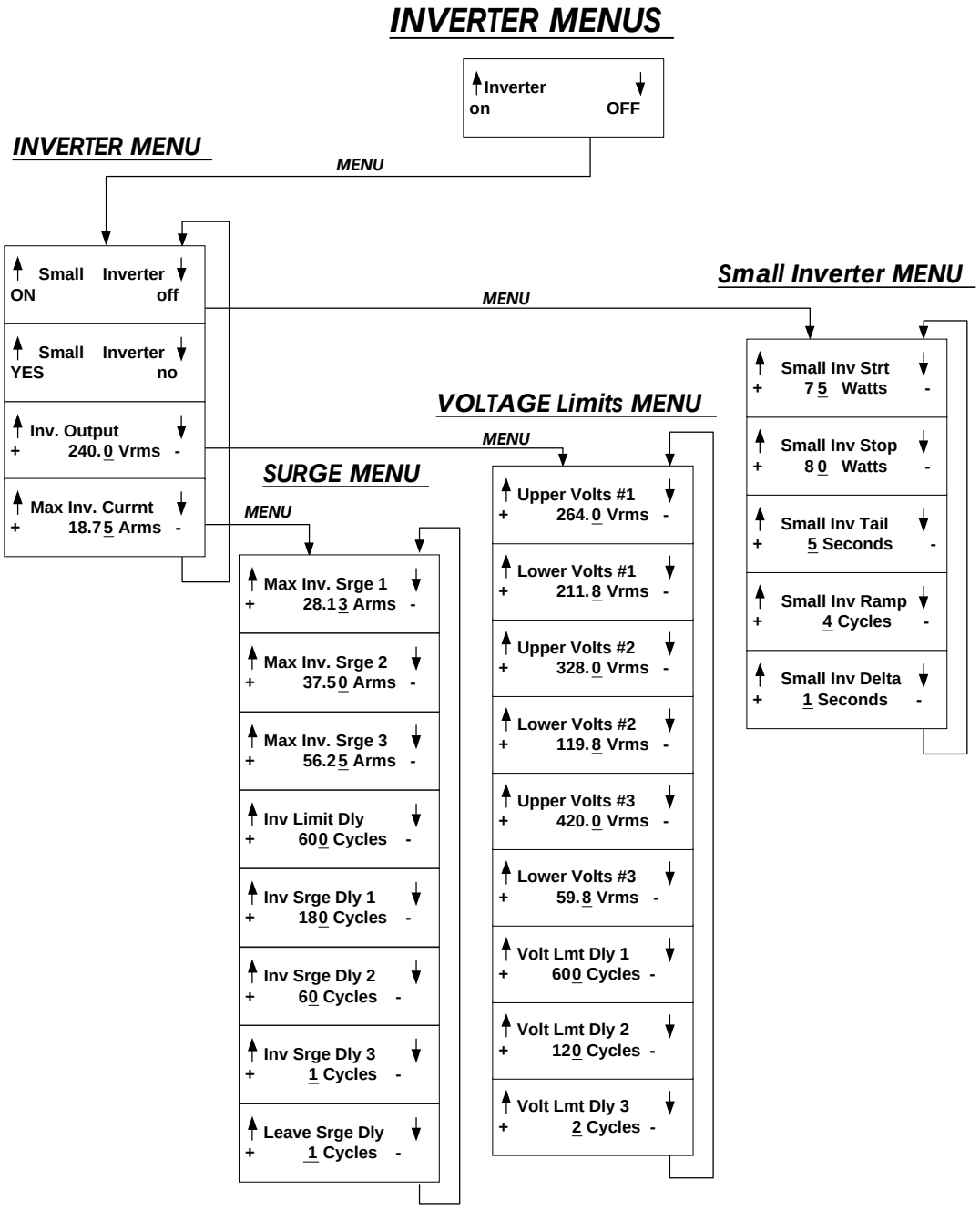
Figure 5-3: Inverter Menu



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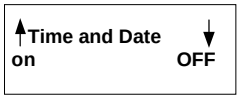
1. Press the Top Right Key next to the ↓ symbol. This will move you to the next menu item. The Display will change to

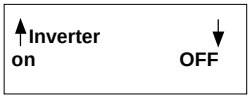
2. Keep pressing the Top Right Key next to the ↓ symbol. You will see that each time you press the key that the screen will advance down the list in Figure 5-1: RE-ICC Menus. If you hold the ↓ key down the menu items will scroll DOWN rapidly.

3. Try pressing the Top Left Key next to the ↑ symbol. You will find that the each time you press the key that the screen will advance up the list in Figure 5-2: Main Menu. If you hold the ↑ key down the menu items will scroll UP rapidly.

   You will also notice that this menu "wraps around". In other words, when you reach the bottom of the list



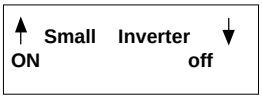
   the next screen to show up will be the "Inverter on / OFF" screen, bringing you back to the top.



   Likewise the same thing happens with the ↑ arrow. The Menu will wrap around with the next item above the Inverter screen being the Time and Date screen.

   As you look at Figure 5-1: RE-ICC Menus, you will notice that the many of the screens have additional menus that can be accessed from them.

   If you are not at the "Inverter on OFF" screen, go to it now and press the "MENU" button. You will now be at a new screen



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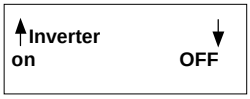
You are now at the first item in the INVERTER Menu. The Inverter Menu structure is shown in Figure 5-3: Inverter Menu.
As you can see, you have options of where to go from here!

4. Press the ESC key. This will take you back to the SETTINGS Menu. The Display should look like the following:



5. Press the ESC key again. This will take you back to the Main screen shown below:

This returns you to the Main Menu.

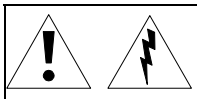
Congratulations! You now know how to navigate the menus!

Note:	**In order to prevent settings that might cause damage to personnel, or property, the RE-4500 has been equipped with password protection to avoid any wrong entry of data.**

The RE-4500 is shipped with the following configuration:

- **User** – (7734) This level of access allows viewing of all the menu items and some limited adjustment of parameters, but no adjustment to the more advanced parameters. Changes are limited to the “Settings” Menu.

For further information on menu items please refer to Appendix B: RE-ICC Menus. This section has the complete menu structure for the RE-ICC.



Warning

Changes to the menu items at any level but the user should only be done by Vanner Authorized personnel. Failure to follow proper procedures and configurations can lead to death, explosion, electrocution, loss of property and equipment, and voiding of warranty!

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Display Menu

This Menu is accessed by pressing the “Menu” button when at the Main Menu. This will bring up the menu show in Figure 5-1: Display Menu. This menu can be used to display status of voltages, currents, power, temperature, or many other monitored status items associated with the RE-4500. The “ESC” key will take you back to the Main menu.

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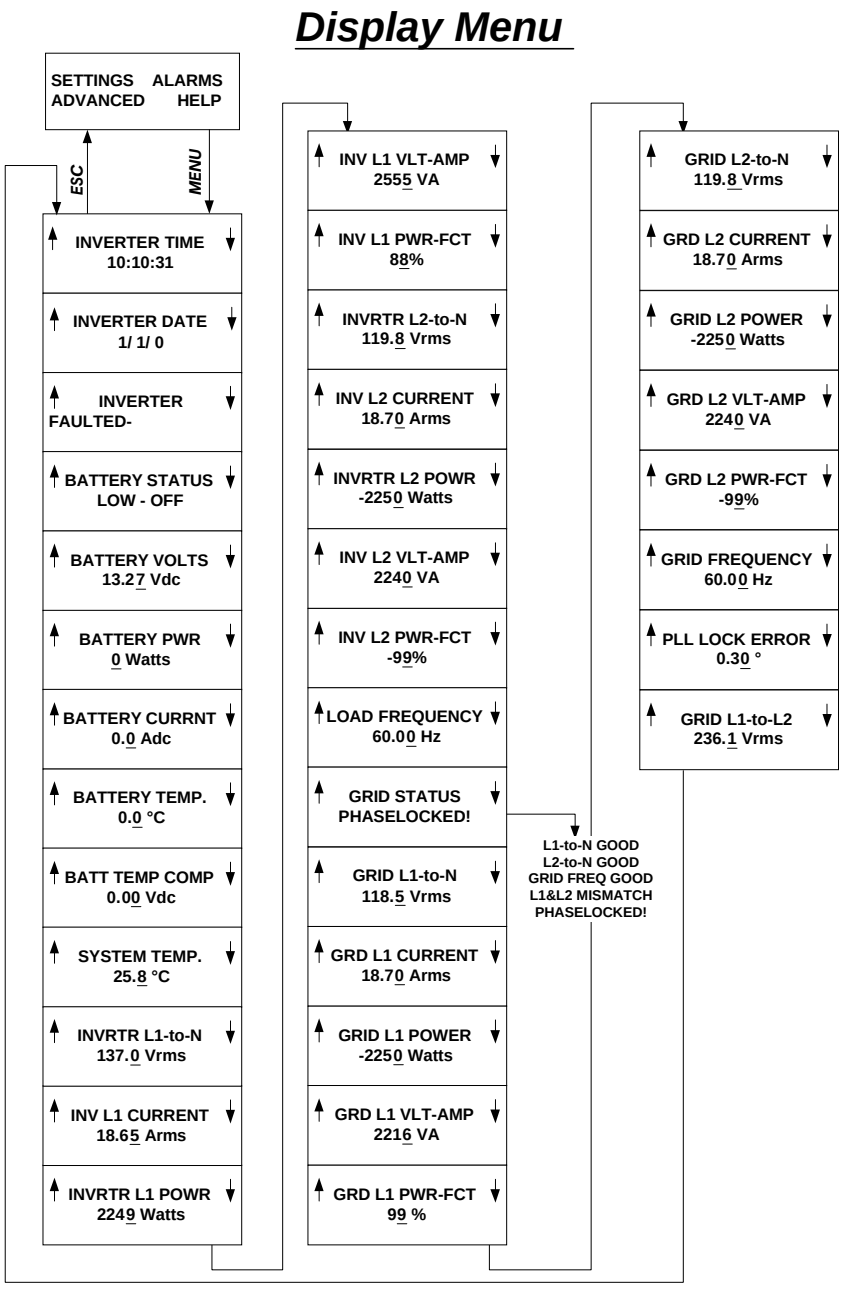
Figure 5-1: Display Menu



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6 Preventive Maintenance and Trouble Shooting Procedures

There are no user serviceable components inside the inverter. If the inverter requires service, refer to the Vanner Incorporated or other qualified service personnel.

Preventive Maintenance

For continued reliability and safety, a monthly maintenance program should be implemented to include the following:

1. Check to insure that all wiring connections are tight, secure and corrosion free.
2. Check fan exhaust and intake vents for obstructions.
3. Examine connectors, indicators and switches for cracks and breaks.
4. Examine any surfaces that are discolored or deformed due to excessive heat.

Trouble Shooting Procedures

The following are the most common questions heard by Vanner service professionals. If your situation does not apply to the following categories, please contact your local Vanner Inc. Service Center or the Vanner Inc. Customer Service Department: 1-800-AC-POWER (1-800-227-6937). Please have your model and serial number available when consulting customer service.

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Preliminary Checks

1. Indicator Light status
2. Inverter ON/OFF Switch position.
3. Battery voltage at battery and battery voltage at the inverter terminals. Voltage present at inverter/charger does not prove that all connections are sound especially under no AC load. (see item 7)
4. DC Fuse condition
5. DC Disconnects condition
6. Battery connections for tightness or corrosion

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Problem Symptoms and Troubleshooting Checks

If you have this problem:	Do this:
Inverter Indicator Light does not turn ON.	Verify DC voltage at the inverter.
Inverter Indicator Light is ON but the AC load will not operate.	Check and reset GFCI receptacle or circuit breakers. Verify AC wiring. Try a different load such as a trouble light.
Low Battery Indicator Light is ON when AC load is applied.	Check battery connections and condition. Recharge battery if voltage is less than 22.0 VDC. Low battery warning is 22 VDC and Inverter Shutdown is 21 VDC (***44VDC and 42VDC for the RE48-4500***). Check to see if Charger is enabled in RE-ICC Settings Menu. Check alarm status on Charger.
Over Temperature Indicator Light is RED.	Verify fan operation. Remove obstructions from air intake vents and exhaust fan.
Inverter Light Turns RED when AC load is applied.	Verify AC load is within the inverter's rated capacity. Remove excessive loads.
DC fuse blows when connecting DC input cables.	Check for reverse polarity (Positive and negative DC cables reversed.)
Excessive audible buzzing during inverter operation but inverter operates loads.	Check mounting bracket bolt tightness.
AC loads do not seem to be fully energized when operating from inverter power.	Check AC output voltage at AC Output Terminals. Check for overheated DC or AC wiring. Verify AC load specifications are not exceeded.
Unit does not operate and a "burnt wire" smell emits from inverter/charger.	Disconnect AC loads and DC Source immediately. Unit may require service, contact Vanner service department.

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Appendix A: Warranty

NORTH AMERICAN LIMITED WARRANTY

Vanner Inc., doing business as The Vanner Inc., referred to herein as Vanner, warrants that this product is free from defects in materials and workmanship for a period of two (2) years from date of installation or two and one half (2 1/2) years from date of manufacture, whichever is less if and only if the following requirements are complied with:

1. The product is installed and checked out properly according to all guidelines, instructions, and checkout procedures set forth in the product Installation and Operating Manual.
2. The installer records all checkout data required and completes, signs, and returns the warranty registration card to Vanner within ten (10) days after installation.
3. The product was purchased after January 1, 2000.

Vanner does not warrant its products against any and all defects when: defect is a result of material or workmanship not provided by Vanner; normal wear and tear, or defects caused by misuse or use in contrary to instructions supplied, neglect, accident, reversed polarity, unauthorized repairs and/or replacements.

Vanner does not manufacture this product for use in a life supporting or life sustaining role. Please contact Vanner if you have any questions along this line.

All warranties of merchantability and fitness for a particular purpose: written or oral, expressed or implied, shall extend only for a period of two (2) years from date of installation or two and one half (2 1/2) years from date of manufacture, whichever is first. There are no other warranties that extend beyond those described on the face of this warranty. Some states do not allow limitation on how long an implied warranty lasts, so the above limitations may not apply to you.

Vanner does not undertake responsibility to any purchaser of its product for any undertaking, representation, or warranty made by any dealers or distributors selling its products beyond those herein expressed unless expressed in writing by an officer of Vanner.

Vanner does not assume responsibility for incidental or consequential damages, including, but not limited to, responsibility for loss of use of this product, removal or replacement labor, loss of time, inconvenience, expense for telephone calls, shipping expense, loss or damage to property, or loss of revenue. Some states do not allow the exclusion or limitation of incidental or consequential damages, so these limitations may not apply to you.

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Vanner reserves the right to repair, replace, or allow credit for any material returned under this warranty. Any damage caused by the customer will be charged or deducted from the allowance.

All warranty work will be performed at Vanner's factory, by authorized Vanner distributors, by Vanner installers/technicians, or a Vanner authorized repair facility utilizing a valid Warranty Authorization Number (WAN) prior to repair. Products shall be delivered to Vanner's facility, freight prepaid and fully insured. Products repaired under warranty, or replacement parts or products will be returned to North American location prepaid via same transportation means and level of service as received, unless directed otherwise. Prepaid freight policy does not apply to locations outside North America.

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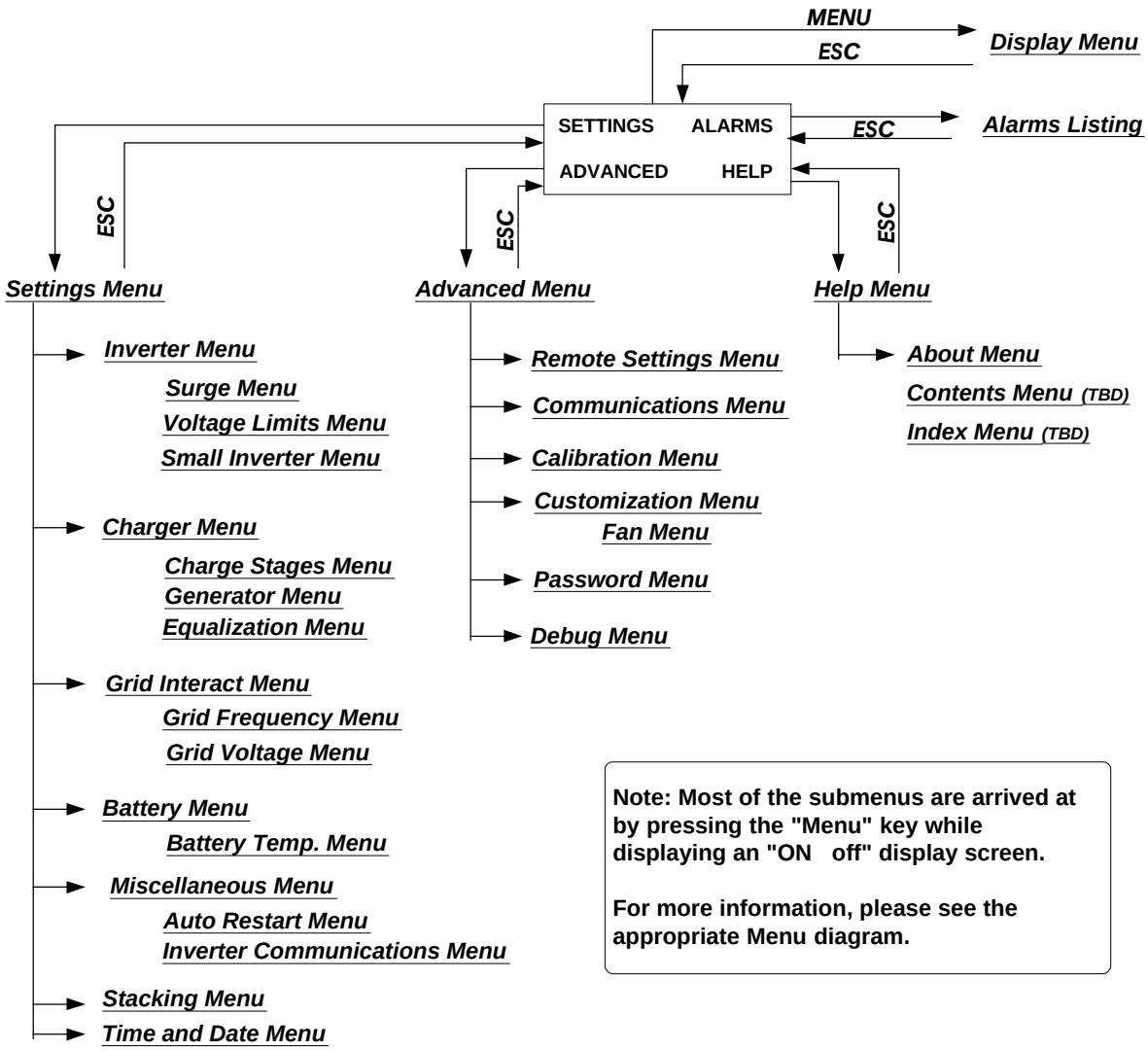
Appendix B: RE-ICC Menus



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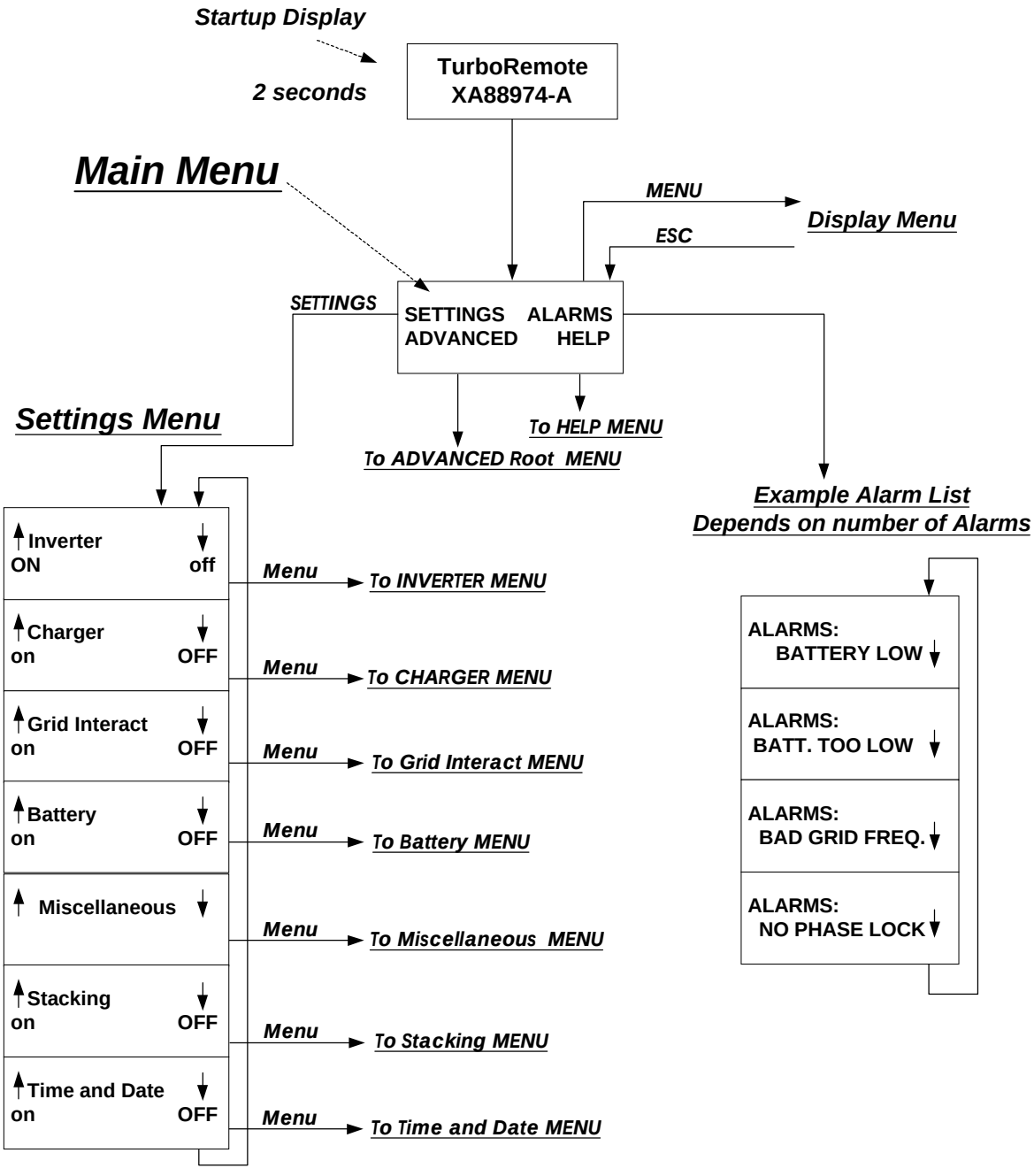

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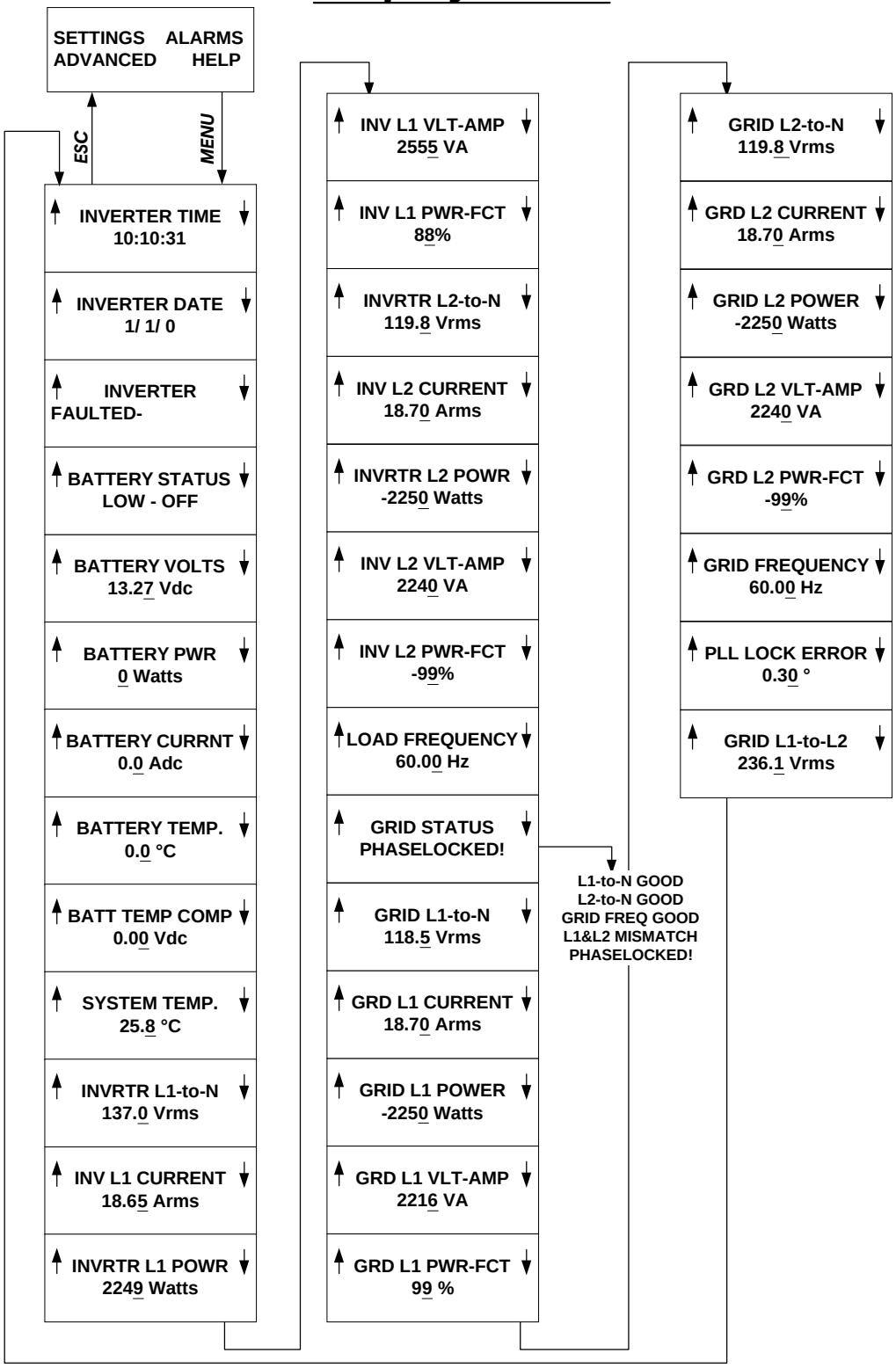
Display Menu



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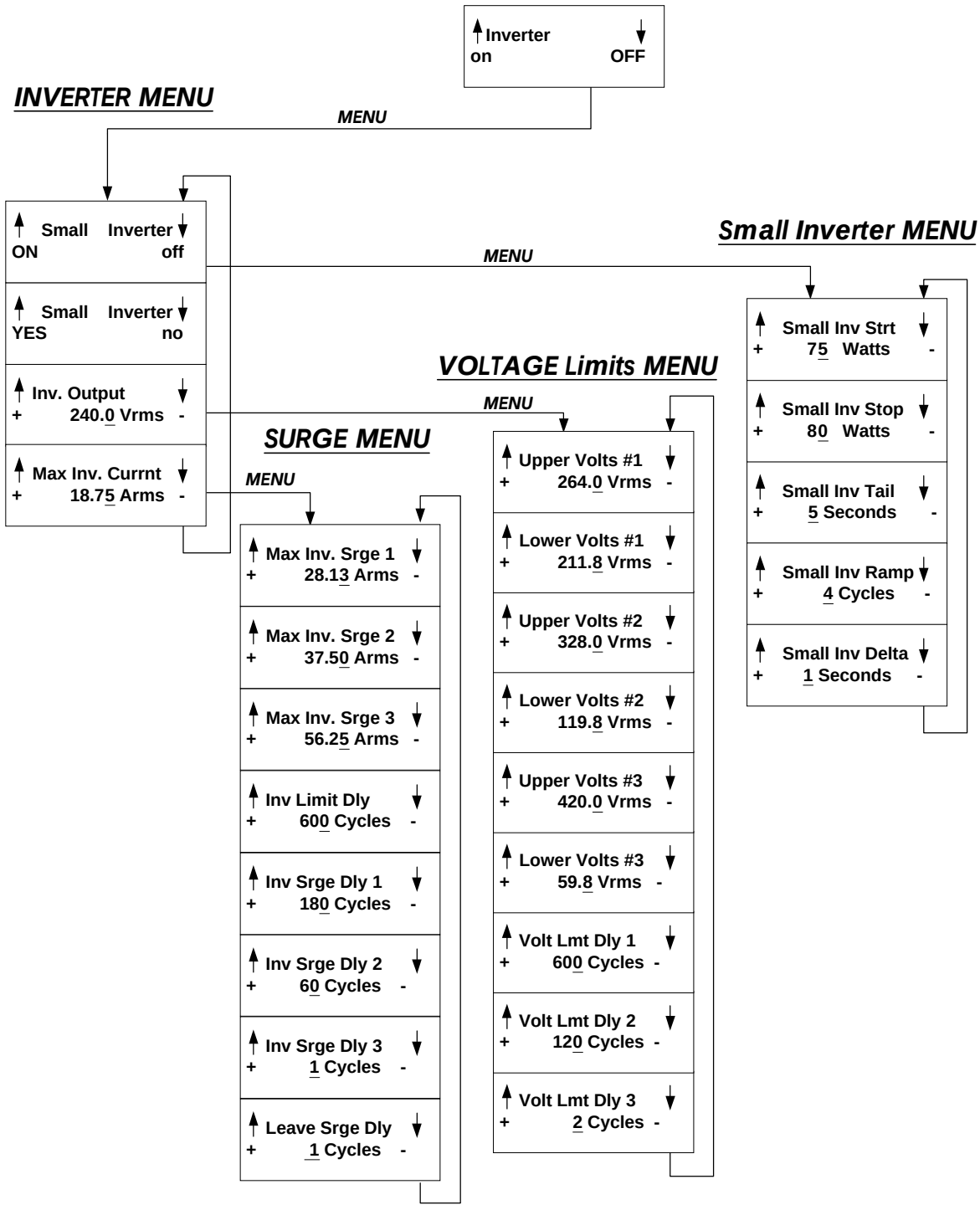
INVERTER MENUS



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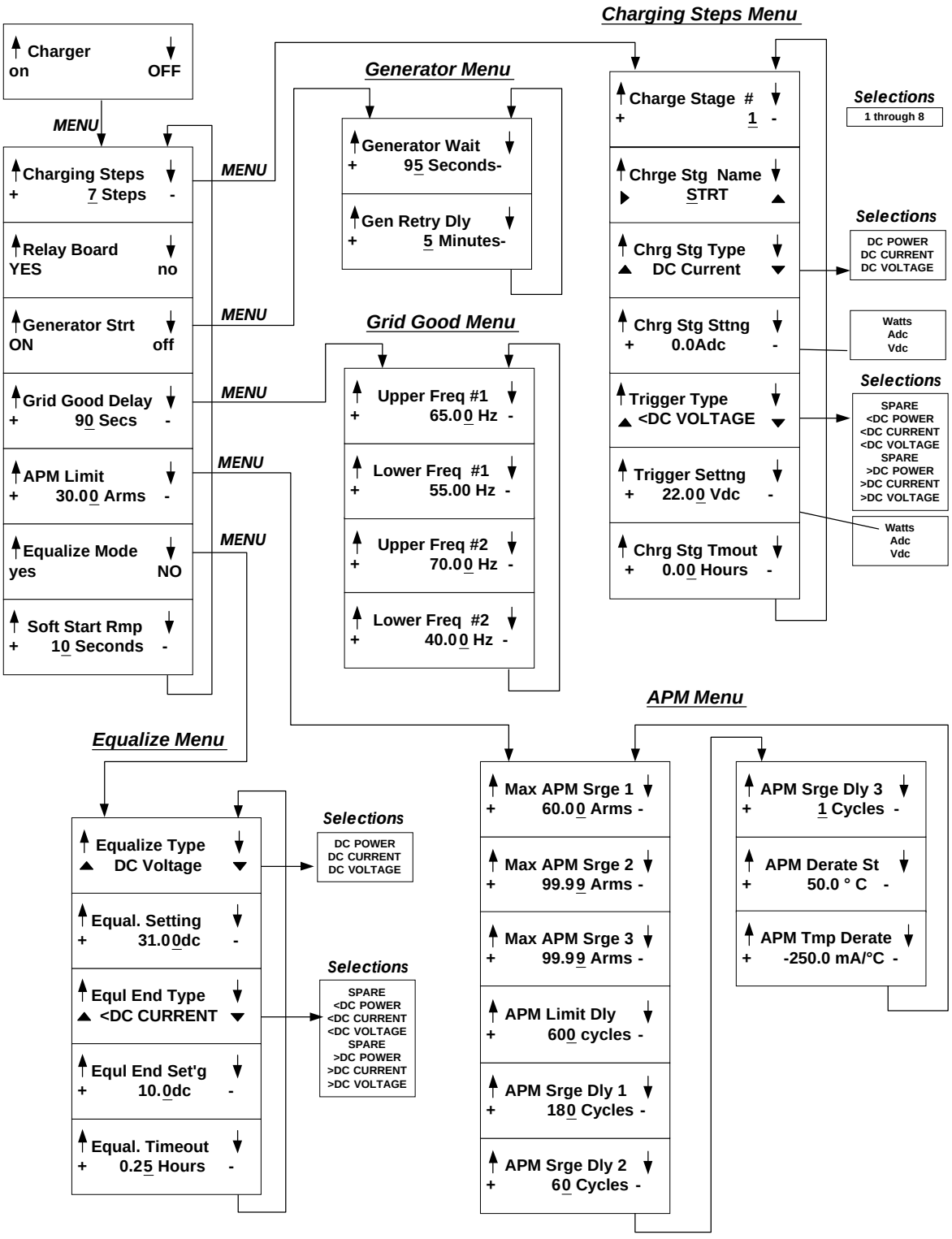
Charger MENU RE24-4500
24V System



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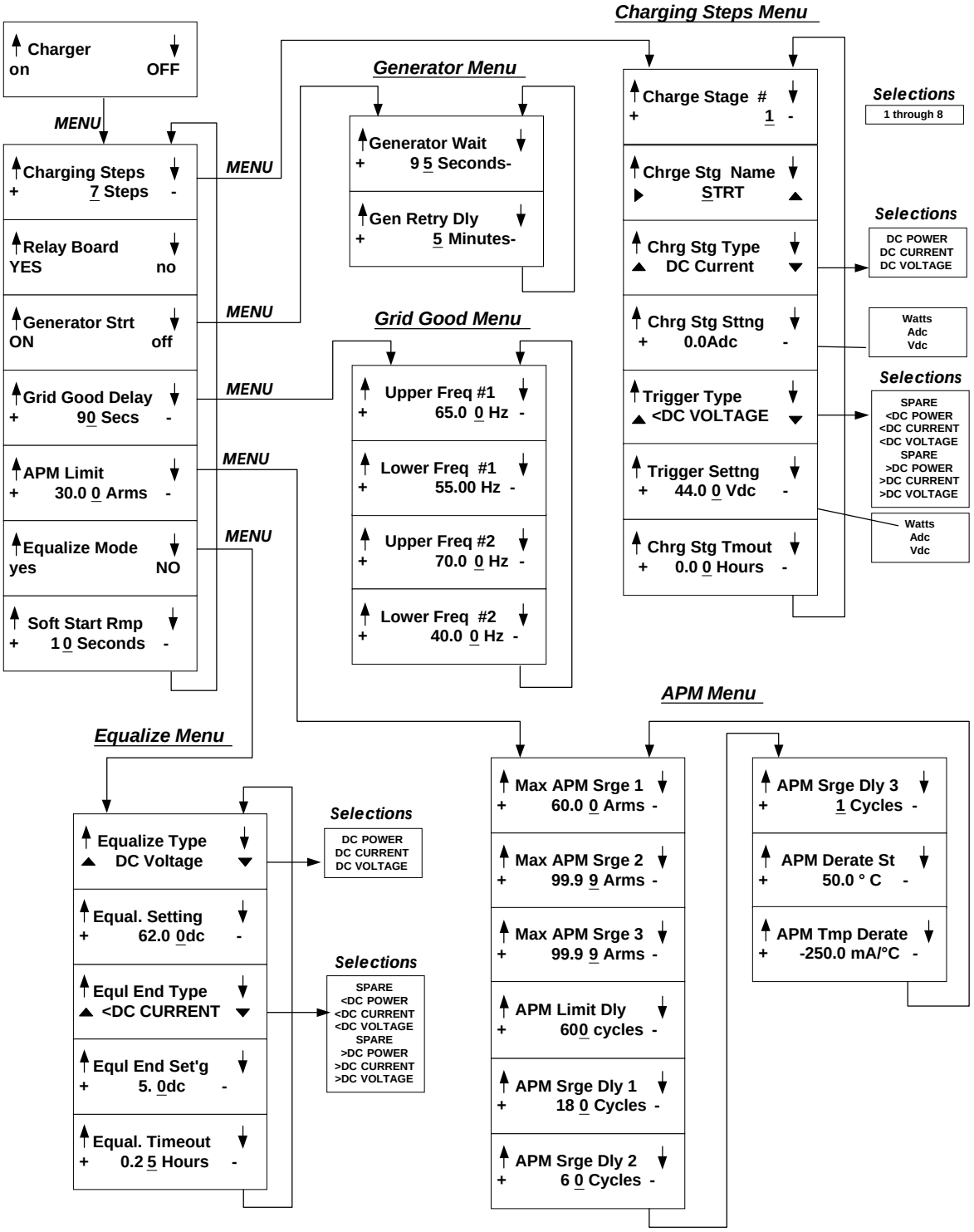
Charger MENU RE48-4500
48V System



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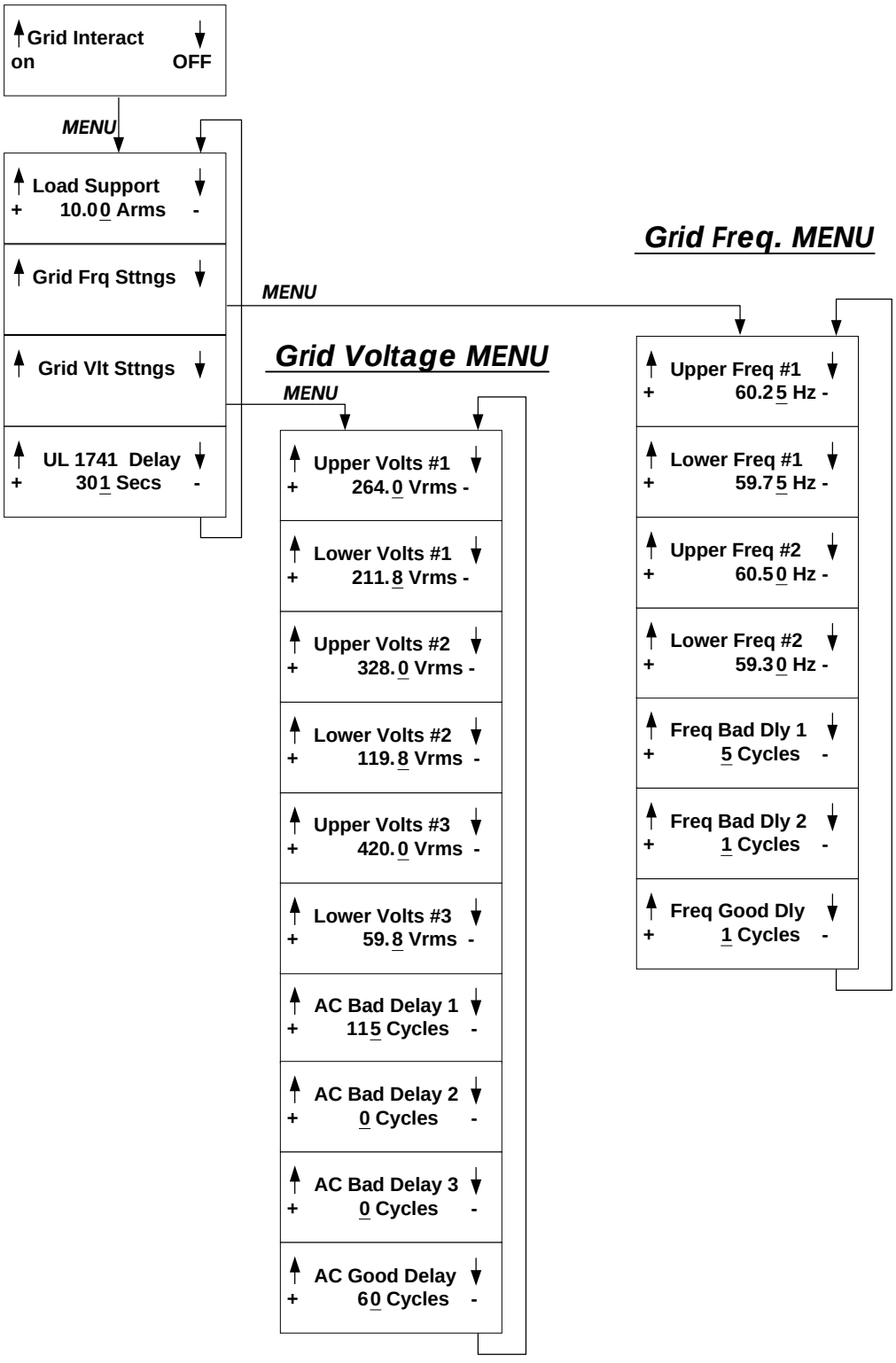
Grid Interact Menus



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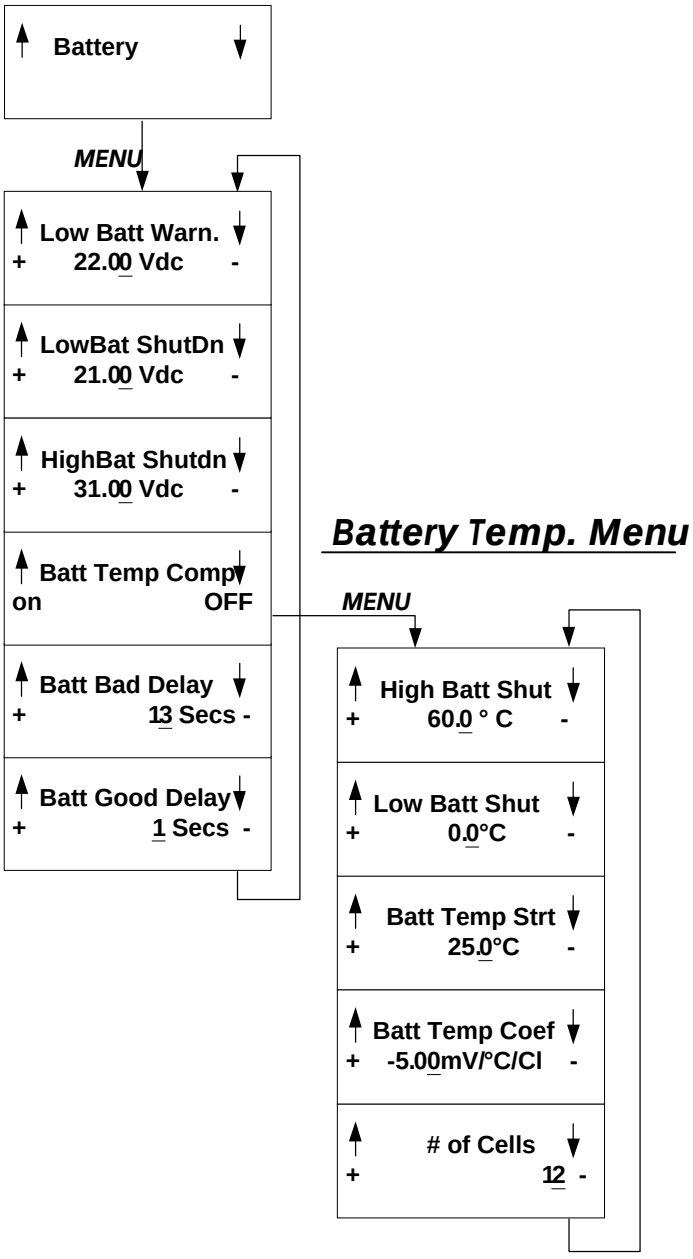
Battery MENU RE24-4500
24 Volt System



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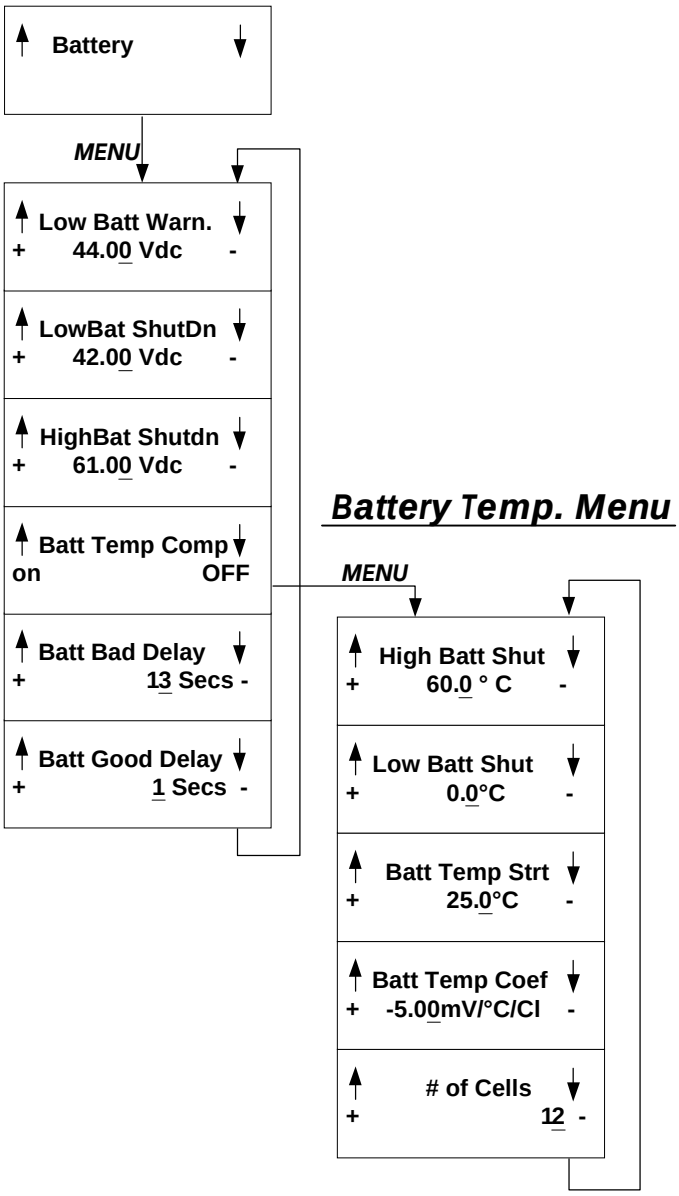
Battery MENU RE48-4500
48 Volt System



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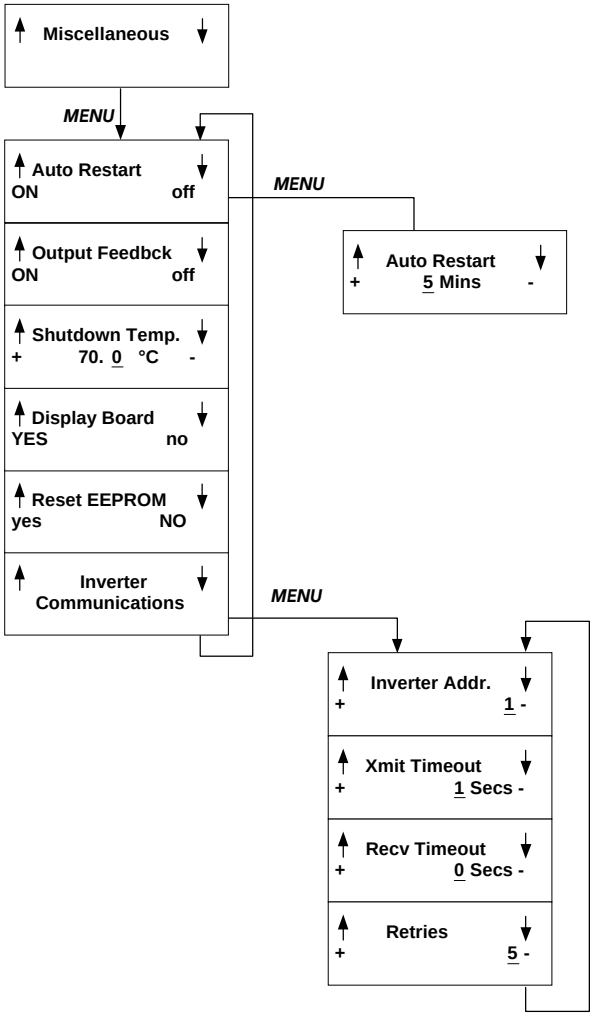
Miscellaneous MENU



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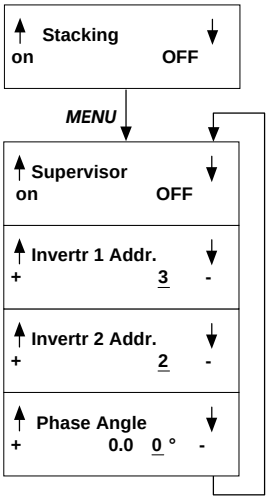
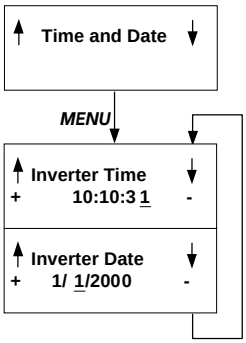
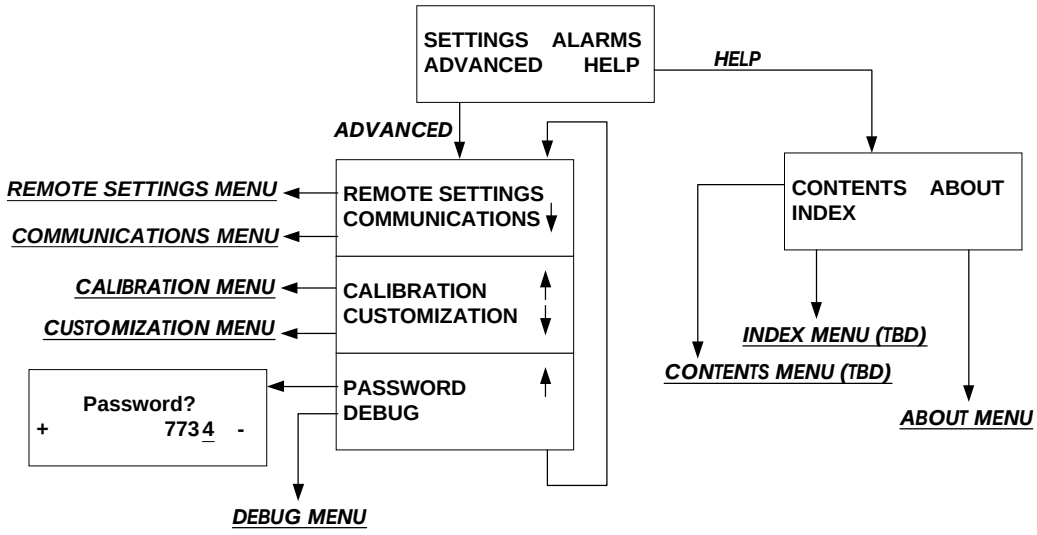
Stacking MENU



Time and Date MENU



Advanced MENU



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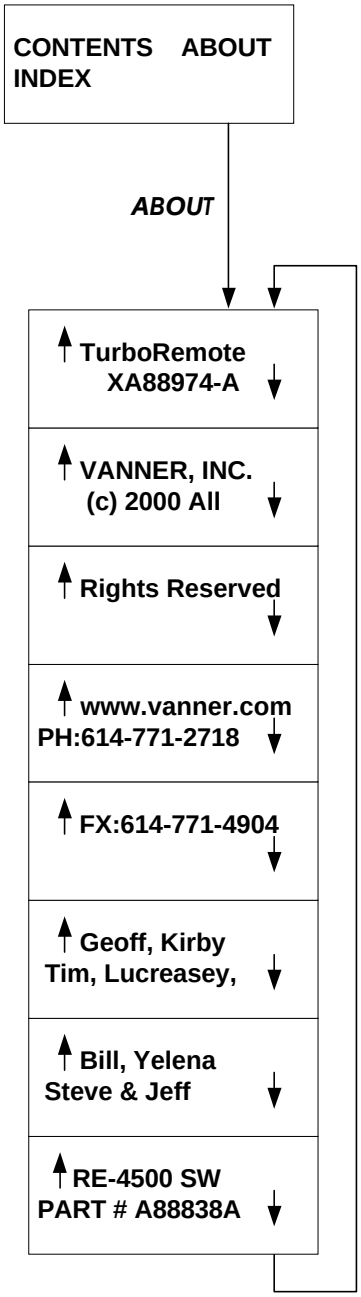
ABOUT MENU



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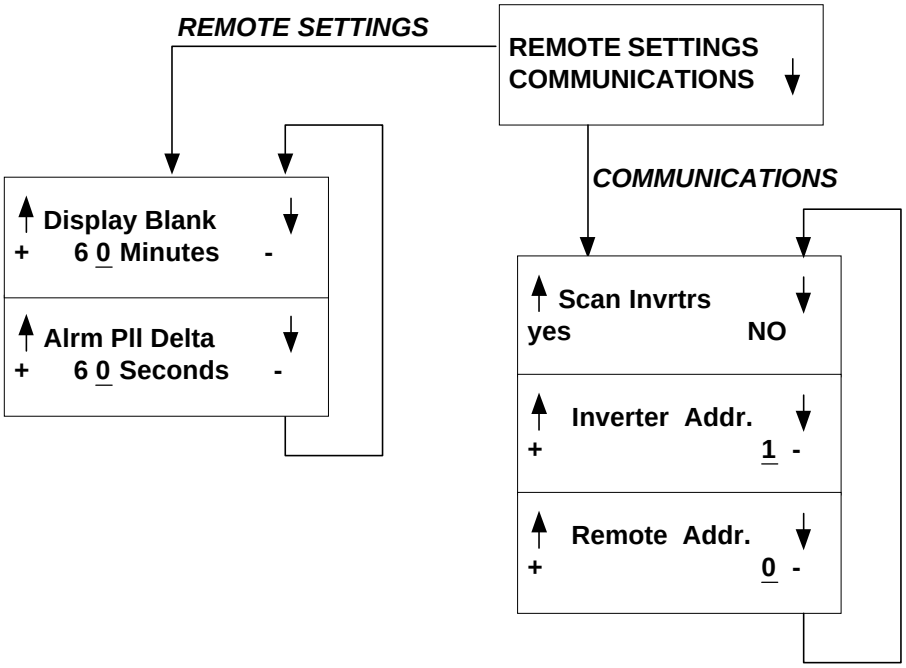
REMOTE SETTINGS MENU



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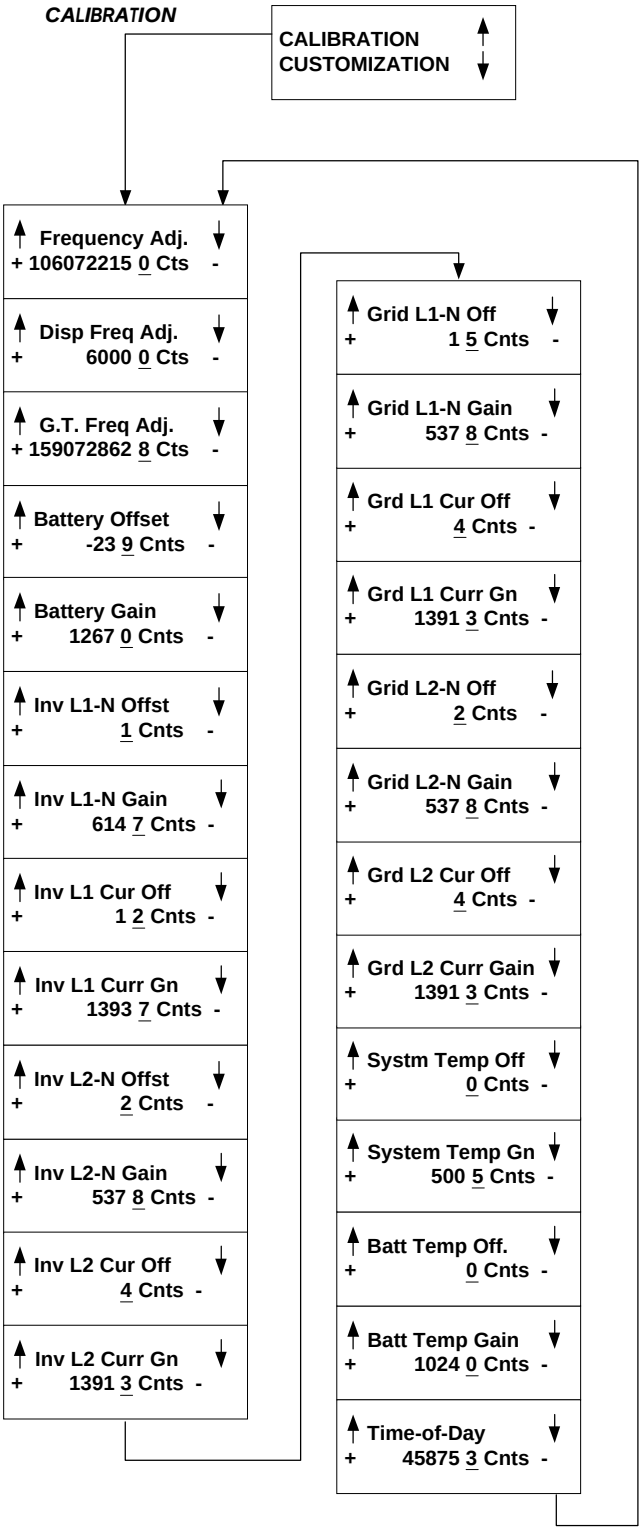
CALIBRATION MENU



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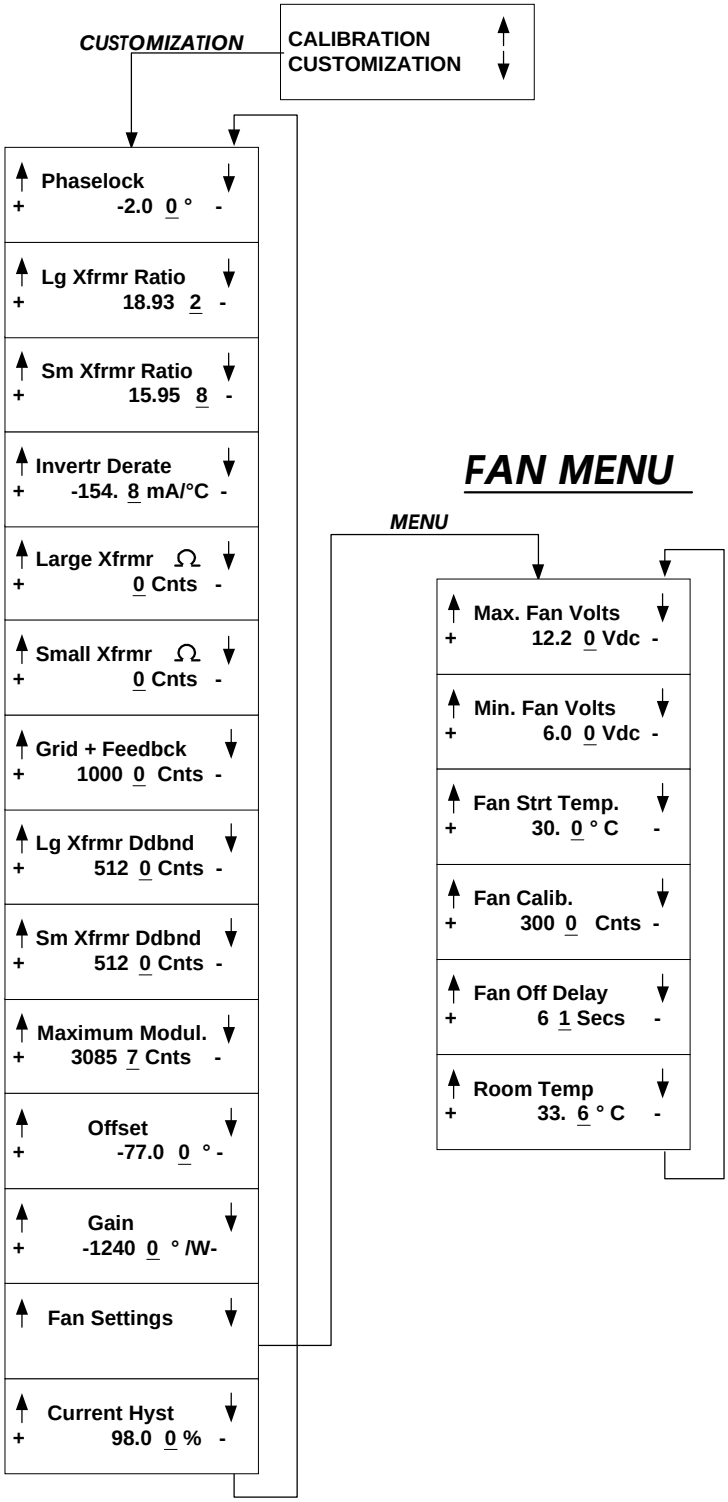
CUSTOMIZATION MENU



FAN MENU

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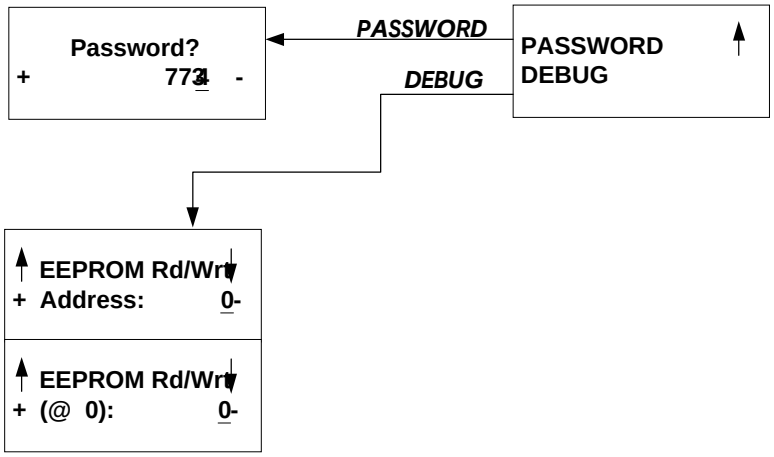
PASSWORD AND DEBUG MENU



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Appendix C: Settings

Alarm Listing

Alarm Display	Description
BATTERY LOW	*Battery Low Warning*
BATT. TOO HIGH	*Battery High Shutdown*
BATT. TOO LOW	*Battery Low Shutdown*
CURRENT LIMIT	*At the Inverter current limit*
BROWNED OUT	*Shutdown because the inverter output voltage has been too low for too long*
BRICK FAULT	*Power stage shutdown*
XFRMR OVERHEAT	*Transformer overheated*
BRICK OVERHEAT	*The power stage overheated*
BATT. OVERHEAT	*The batteries overheated. Note: Battery temperature compensation must be ON*
SYS. OVERHEAT	*The internal temperature sensor reported >60 degrees C.*
SURGING...	*The load is greater than the inverter current limit; not limiting yet.*
BAD GRID FREQ.	*The utility or generator frequency is bad. (The voltage might be OK).*
PHASE MISMATCH	*Line 1 and Line 2 voltages don't agree.*
NO PHASELOCK	*The transfer relay has not yet energized. The voltage and frequency of the grid might be OK.*
GRID L1-N BAD	*Bad phase voltages*
GRID L2-N BAD	*Bad phase voltages*
OPEN FUSE	*The small inverter has blown its fuse*
SOFTWARE FAULT	*Software error - Checksum*
BATTERY DEAD	*Battery Low Shutdown, no charging. < 1/2 Battery Low Shutdown value.*
INVERTING	*Normal*
INVERTING-SMAL	*Inverting "low power" with small inverter*
L1-N OUT BROWN	*L1 in current regulation mode (brown-out)*
L2-N OUT BROWN	*L2 in current regulation mode (brown-out)*
L1 IN SURGING	*L1 Coming up on APM limit*
L2 IN SURGING	*L2 Coming up on APM limit*
L1 APM LIMIT	*L1 is at APM Limit*
L2 APM LIMIT	*L2 is at APM Limit*

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Calibration Data

Item	Value	
Frequency Adj.		Cnts
Disp. Freq. Adj.		Cnts
G.T. Freq Adj.		Cnts
Battery Offset		Cnts
Battery Gain		Cnts
Inv L1-N Offset		Cnts
Inv L1-N Gain		Cnts
Inv L1 Cur Off		Cnts
Inv L1 Curr Gn		Cnts
Inv L2-N Offset		Cnts
Inv L2-N Gain		Cnts
Inv L2 Cur Off		Cnts
Inv L2 Curr Gn		Cnts
Grid L1-N Off		Cnts
Grid L1-N Gain		Cnts
Grd L1 Cur Off		Cnts
Grd L1 Curr Gn		Cnts
Grid L2-N Off		Cnts
Grid L2-N Gain		Cnts
Grd L2 Cur Off		Cnts
Grd L2 Curr Gn		Cnts
Systm Temp Off		Cnts
System Temp Gn		Cnts
Batt Temp. Off.		Cnts
Batt Temp Gain		Cnts
Time-of-Day		Cnts

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Appendix D: Application Notes

Application Notes

Please refer to the Vanner Incorporated Web site for Application notes at http://www.vanner.com.

Applicable Documents

National Electric Code 1999
NEC Article 690
UL-1741
IEEE-929
[1] G.A. Kern, R.H.Bonn, J. Ginn, S. Gonzalez *Results of Sandia National Laboratories Grid-Tied Inverter Testing*, July 1998

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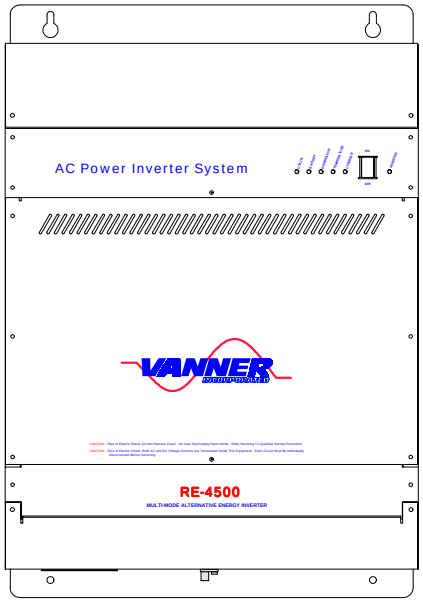
RE SERIES

Renewable Energy True Sine Wave
AC Power Inverter/Charger



Model
RE24-4500
RE48-4500

Installation Manual #D910157-A

07/17/01 12:08 PM

Notes

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1 Introduction

Thank you for purchasing a Vanner RE-4500 Renewable Energy Inverter System. We are confident that you will be satisfied with its performance and its many features. With proper installation and care, you can look forward to years of service from this high performance product.

"***RE-4500***" stands for **R**enewable **E**nergy **4500** Watt, Inverter System. The specific model numbers covered in this document are the "***RE48-4500***" and "***RE24-4500***" which designate 48VDC or 24VDC respectively.

The ***RE SERIES*** is a family of dependable inverters designed to meet the service requirements of the Renewable Energy market and produce true sine wave AC output power.

This document will describe the installation procedures for the RE-4500. We suggest that you acquaint yourself with this model inverter/charger and any optional accessories that you have purchased before proceeding with this manual. If you require additional information please contact your dealer, or contact us directly at 1-800-227-6937 (800 AC POWER).

WARNING:	**Before you install and use your *RE SERIES* Inverter/Charger be sure to read and save these safety instructions.**

WARNING:	**The RE-4500 is not designed to be a part of Life Supporting or Life Sustaining Equipment. If the Unit is to be used in such an application, please contact Vanner Inc. at 1-800-ACPOWER.**

The ***RE SERIES*** product line is designed to meet the requirements of a variety of applications.

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Save these instructions!

Please note your model and serial number here for future reference.

Model No._____

Serial No._____

Date of Installation_____

This document describes the operation, technical specifications and installation procedures for the RE-4500 Inverter/Charger System. If you require additional information please contact your dealer or contact Vanner at 1-800-AC POWER (1-800-227-6937).

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2 Important Safety Instructions

WARNING:	**Before you install and use your RE-SERIES AC Power Inverter, read and save these safety instructions!**

This manual contains important safety and operating instructions for the Vanner Incorporated RE-4500 Power Inverter that shall be followed during installation and maintenance of the inverter as prescribed by Underwriters Laboratories (UL). The RE-4500 inverter is listed as compliant with UL 1741 Power Conditioning Units for use in Residential Photovoltaic Power Systems.

Warning Labels
Please READ ME

It should be noted that hazardous voltages are associated with this product. This unit has connections to both DC at lethal amperages and AC at lethal amperages and voltages.

Installation should only be done by qualified personnel and in compliance with local regulations and codes.

Special care must be taken in working around the RE-4500 Inverter/Charger System in order to avoid hazardous voltages and currents.

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NOTE:	**In order to reduce the risk of damage to personnel or equipment, please read all instructions in this manual, particularly warnings noted by the following symbols.**

These symbols are used to note procedures that if not closely followed could lead to loss of life or damage to equipment or property due to electrocution.

A potentially dangerous condition

Electrocution hazard exists

Fire hazard exists

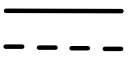
Explosive hazard exists

Corrosive hazard exists

The following are additional symbols used in identifying other aspects of the RE-4500.

AC

This symbol denotes AC Voltage is potentially present on this termination.



DC Voltage

This symbol denotes DC Voltage is potentially present on this termination.

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L1 — **Phase 1**

This symbol denotes that this termination is used for the upper phase of a 240 Vrms 3 wire system consisting of Phase 1 (Black wire), Neutral (White wire), and Phase 2 (Red wire).

N — **Neutral**

This symbol denotes that this termination is used for the middle wire of a 240 Vrms 3 wire system consisting of Phase 1 (Black wire), Neutral (White wire), and Phase 2 (Red wire).

L2 — **Phase 2**

This symbol denotes that this termination is used for the lower phase of a 240 Vrms 3 wire system consisting of Phase 1 (Black wire), Neutral (White wire), and Phase 2 (Red wire).

GND — **Ground**

This symbol denotes that this termination is used for a ground connection (Green wire).

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Safety Instructions

	Caution **Read owners manual BEFORE wiring or powering up.**
	Caution **DO NOT cover or obstruct ventilation openings. DO NOT mount in a zero-clearance compartment. Overheating may result.**
	Warning **Under high ambient temperature / high-power-output conditions some parts of the inverter may become hot enough to cause burns. The unit should be installed so that it is not to be contacted by personnel.**
	Warning **Improper use of this product may result in risk of electrical shock. Both AC and DC voltage sources are terminated inside this equipment.**
	Warning **This equipment employs components that tend to produce arcs and sparks. To prevent fire or explosion, DO NOT install in confined areas or compartments that contain batteries or flammable gases and materials.**
	Danger **Battery connections are for disconnection only, NOT for current interruption.**

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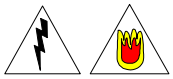
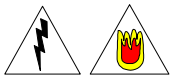
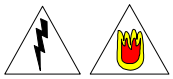
General Precautions

	Do not expose the inverter/charger to direct water spray, rain, or snow.
	To reduce the risk of a fire hazard, do not cover or obstruct the ventilation openings.
	Do not install the inverter in a zero clearance compartment. This may result in overheating and/or diminished performance.
	**To avoid the risk of fire, electrical shock, or injury to persons, do not use attachments not recommended or sold by Vanner Incorporated.**
	Vanner recommends that all AC and DC electrical wiring be performed by a licensed electrician or a qualified technician to ensure compliance with all applicable national and local wiring regulations.
	**To avoid a risk of fire and/or electrical shock, always verify wiring connections are in good electrical condition. All external conductors must use proper wire size to avoid dangerous overheating and/or diminished performance.**
	If the inverter has been dropped or damaged in any way, do not operate the inverter until it has been verified to be safe by a qualified technician.
	To reduce the risk of electrical shock, always disconnect the AC and DC connections using the code required AC and DC disconnects. The On/Off switch only turns off the Inverter electronics. Dangerous AC and DC Voltages Are Still Present!
	The inverter must be properly grounded in accordance with local and national codes and ordinances before operation. For most installations, the negative (ground) conductor should be bonded to the grounding system at one and only one point in the system.
	For optimum inverter/charger performance, battery temperature should be above 32 degrees Fahrenheit.
	**Do not disassemble the inverter/charger. See the service section of this manual for instructions on obtaining service. Attempting to service the inverter yourself may result in a risk of electrical shock, fire and/or loss of warranty.**

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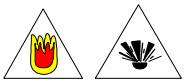
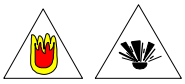
	Always use service disconnects to break the circuit before attempting any kind of servicing of the RE-4500. DO NOT attempt to service the unit while still actively connected to a power source of any kind.

Explosive Gas Precautions

	**This equipment contains components, which tend to produce arcs or sparks. To prevent fire or explosion, do not install in compartments containing batteries or flammable materials, or in locations that require ignition protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connections between components of the fuel system.**
	**To reduce the risk of battery explosion, follow these instructions, the battery manufacturer instructions, and the instructions of the manufacturer of the equipment in which the battery is installed. Working near a lead-acid battery is dangerous. Batteries generate explosive gases during normal battery operation.**

Battery Precautions

	Always have someone within range of your voice to come to your aid when you work near a lead-acid battery.
	Have close access to plenty of fresh water and soap in case battery acid contacts skin, clothing, or eyes.
	Always wear complete eye protection and clothing protection. Avoid touching eyes while working near batteries.
	If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 20 minutes. Get medical attention immediately.
	NEVER smoke or allow a spark or flame near a battery. Gases produced by batteries are explosive.
	Be careful when working with metal tools around batteries. Potentials exist for sparks or short-circuit of the battery or other electrical part which could cause an explosion.

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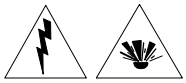
	Before attempting any sort of wiring for the DC supply to the Inverter, turn off the DC disconnect associated with the Batteries. For Safety, ALWAYS check the operation of the disconnect with a voltmeter!
	**In addition to the lethal current associated with the batteries, care must be taken to avoid any potential problems or explosions from the batteries. ALWAYS comply with the battery manufacturer's and local code requirements/guidelines for the installed battery system.**

Code Compliance

Vanner Model RE-4500 is certified by Underwriter's Laboratory to meet UL listing 1741 for Photovoltaic Systems, and complies with IEEE 929 and the National Electric Code Article 690, Solar Photovoltaic Systems.

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3 Installation And Start-Up

This section contains 2 versions of the installation procedures: one for the experienced installer which is designed for installers familiar with the system, and a second for a new installer who may be unfamiliar with the Inverter/Charger system.

Please refer to the appropriate Installation procedure for your level of expertise.

Quick Install and Start-up

This section is designed for the experienced installer who is already familiar with the RE-4500, and has previously installed these units.

Mounting

The RE-4500 weighs approximately 95 pounds and is designed for vertical mounting. Mounting bolt pattern is 16” horizontal x approximately 30” vertical. Use the Mounting Template supplied with the unit to assist in mounting the unit.

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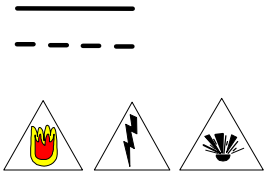
Locate a secure, dry, flat vertical surface large enough to mount the inverter. The location should be as close to the battery as possible, usually within six feet, but not in the same compartment and should provide adequate ventilation while the inverter is operating. The location must be clean, dry, free of dripping water, snow, or other moisture contamination.

Warning

Allow 12 inches minimum clearance below the RE-4500 for the Fan to provide adequate cooling.

This will insure that the Inverter does not overheat due to inadequate airflow.

Wiring connections



Warning

It is important to disconnect ALL DC and AC sources to avoid electric shock!

DC and AC Voltage is extremely dangerous and contact with DC and AC Currents can lead to injury, damage to property, and death!

Use the DC and AC disconnects to insure that ALL potentials are disabled.

All of the inverter's electrical connections are labeled.

Remove the access covers to the DC and AC raceways as shown in Figure 3-2 and Figure 3-3.

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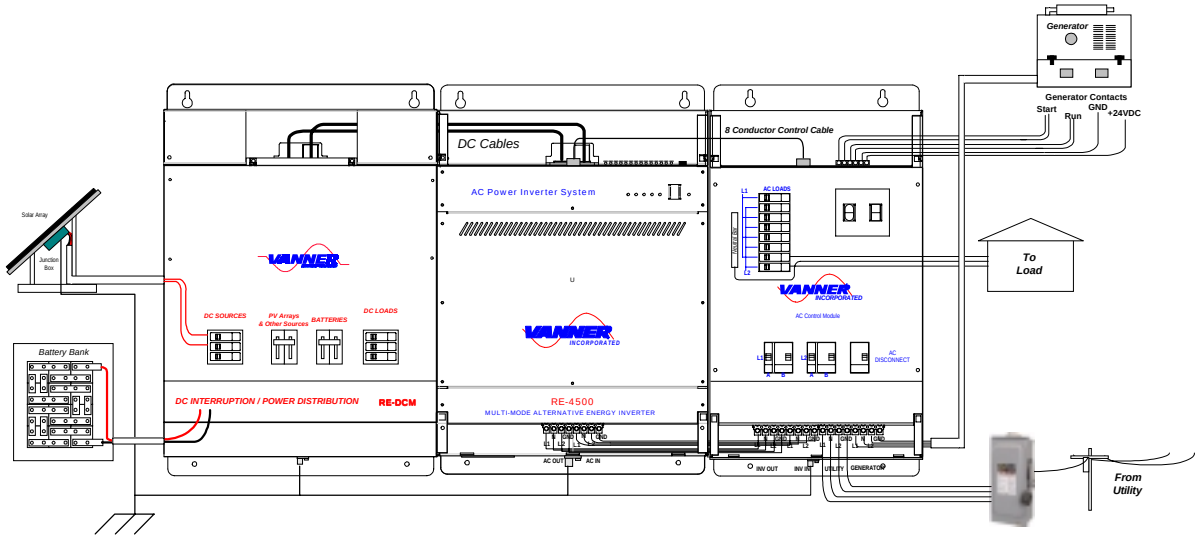
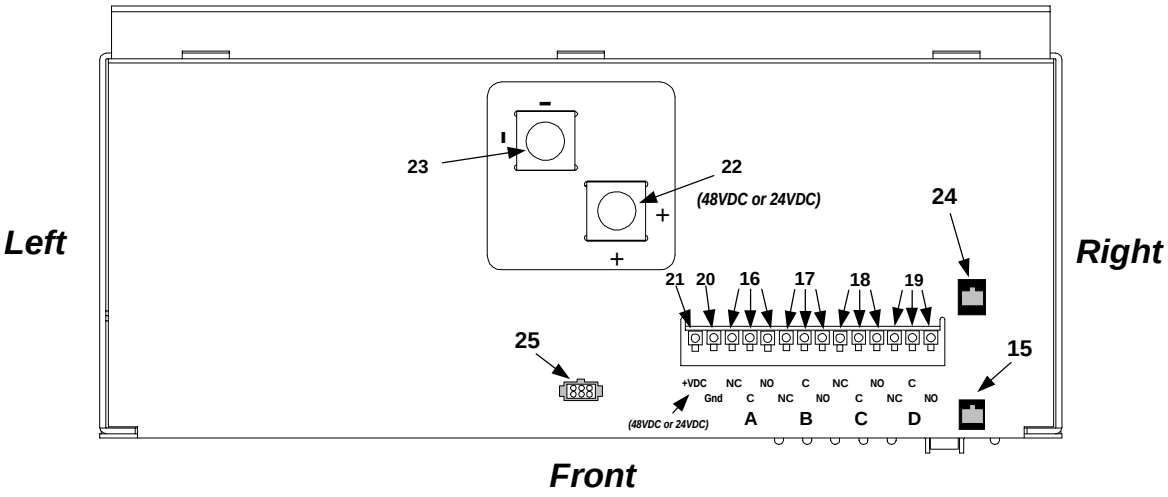
F 1 Figure 3-1: RE-4500 System Connections



F 2 Figure 3-2: Inverter DC Raceway Connections



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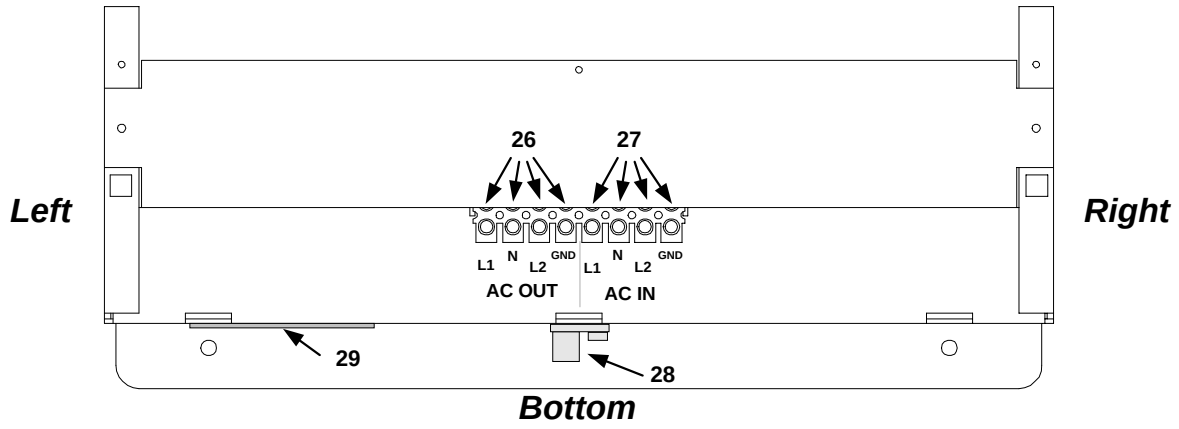
F 3 Figure 3-3: Inverter AC Raceway Connections



Warning

Class 1 Wiring Methods Are To Be Used For Field Wiring Connections To Terminals Of A Class 2 Circuit. It Is Also Extremely Important To Observe A Physical Separation Between Class 1 And Class 2 Circuits. Be Sure To Route Class 1 And Class 2 Wiring Through Separate Knockouts And Conduits.

Terminal and Component Definitions

This section contains the descriptions of the connectors and components called out in Figure 3-2 and 3-3.

(22) and (23) DC connections

Connect 24 or 48 volt DC (depending on your RE model) positive and negative to the inverter's flat DC terminals with 5/16 cap screws. Use 5/16 ring terminals or compression lugs. For the RE24-4500 use a #02286-08, JJN-400, 400A fast blow fuse and 4/0 cable, and for the RE48-4500, use a #02286-03, JJN-200, 200A fast blow fuse. This fuse is required by UL to be within 18 inches of the Battery Terminals on the battery string.

The wiring of your inverter installation should conform to the National Electric Code (NEC) and any other state or local codes in effect at the time of installation. These codes have

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been written for your protection and their requirements should be followed.

(15) Battery Temperature Sensor Monitor Port

This RJ11 Port enables battery bank temperature monitoring with the optional Vanner Battery Temperature Sensor (Vanner Part Number RE-BTS1). This sensor is used for optimizing battery charging efficiency, extending battery life, and battery fault monitoring.

Warning

This connector is for the Battery Temperature Sensor only! Attaching any other device to this connector can result in loss of life, damage to the system, and voiding of your manufacturers Warranty.

Check your terminations carefully!

(16) Relay A Contacts – Low Batt

These terminals are available to the user from the RE-4500 and can be used for several programmable functions. These three Terminals are designated as Normally Open, Common, and Normally Closed.

This Relay's factory default use is for **Low Battery Alert**.

(17) Relay B Contacts

These terminals are available to the user from the RE-4500 and can be used for several programmable functions. These three Terminals are designated as Normally Open, Common, and Normally Closed.

This relay's factory default use is undefined at this time.

(18) Relay C Contacts

These terminals are available to the user from the RE-4500 and can be used for several programmable functions. These three Terminals are designated as Normally Open, Common, and Normally Closed.

This relay's use is for the **Generator Start** Contacts.

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(19) Relay D Contacts

These terminals are available to the user from the RE-4500 and can be used for several programmable functions. These three Terminals are designated as Normally Open, Common, and Normally Closed.

This relay's factory default use is undefined at this time.

(20) Control Relay Ground Terminal

This is a ground pin for the auxiliary output voltage from the main DC bus. This terminal can be used for the creation of a wetting voltage for the internal relay contacts

(21) Control Relay VDC

This is actually an unregulated auxiliary output voltage from the main DC bus. In the case of the RE24-4500, this voltage will be 24 V_{DC} and can be used as a wetting voltage directly for the internal relays. In the case of the RE48-4500 this voltage will be 48 V_{DC} and can be used to wet 48V_{DC} contacts current limited to 1 amp.

(22) Positive Termination From +VDC Power Source

Attach either +24 VDC or +48 VDC (depending on your model) Positive feed to this terminal

Warning

Check Polarity Carefully! Attaching the Negative supply to this terminal can result in loss of life, damage to the system, the batteries, and voiding of Warranty.

Check your terminations carefully!

!!Make Certain that the proper voltage is connected to the unit – 24VDC for the RE24-4500, and 48VDC for the RE48-4500. Damage will result if improper voltage is applied.

(23) Negative Termination From DC Power Source

Attach either +24 VDC or 48 VDC (depending on your model) Negative (Ground) feed to this terminal.

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Warning

This terminal is grounded to the Inverter Chassis.

Check Polarity Carefully! Attaching the Positive supply to this terminal can result in loss of life, damage to the system, the batteries, and voiding of Warranty.

Check your terminations carefully!

(24) Serial Control Connection

This RJ-11 jack is for serial communication between the RE-4500 and another computer/controller. This jack can be used for interface to the optional Vanner RE-ICC (Inverter Charger Controller) – Vanner Part RE-ICC. Alternately, if the user wishes to control and monitor the RE via another computer running the Windows RE-ICC for Windows, the optional Vanner RE Communications Interface Cable will attach to this port.

Warning

This connector is for the Serial Controller Only (such as the RE-ICC or RE Interface Cable)!

Attaching any other device to this connector can result in loss of life, damage to the system, and voiding of the manufacturers Warranty.

Check your terminations carefully!

(25) AC Generator Control Connector

This port is utilized to command multiple RE Components in a system. It functions to communicate with the ACM to control the Generator. It utilizes the MultiUnit Command and Control Cable.

(26) AC Output

Connect 120/240 volt single phase load L1, L2, N, GND to AC output terminals using 10 gauge wire minimum.

(27) AC Input

Connect a 240 V_{rms} Three wire source L1, L2, N, and GND to the AC input terminals using 10 gauge wire minimum.

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(28) Chassis Ground

Connect to compression fitting terminal using 10 gauge wire minimum.

(29) Exhaust Fan

This port is used to exhaust the cooling air from the unit.

Controls

All controls are located on the front of the unit. This includes the ON/OFF Switch found on the front of the unit. The optional Inverter Charger Controller, RE-ICC/LCD is also available for remote command of the RE-4500. For more information on the RE-ICC/LCD, please refer to the RE-4500 Owners Manual.

Use the Main ON/OFF Switch to turn the system (inverter/charger) ON and OFF.

Note:	**The RE-ICC Terminal does not function if the Main ON/OFF Switch is OFF.**

Indicator Lights

All indicator lights are multicolor and will display OFF, green, orange, or red. LED displays are described on in the RE-4500 Owners Manual Component Identification section.

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Testing Procedure

This section is designed to be utilized by a experienced installer or electrical contractor who has prior experience with installation of the RE-4500 and is to provide an installation procedure checklist to insure that the Inverter has been installed properly.

Perform the following checks before continuing:

1. Mount the inverter properly mounted with sufficient ventilation.
2. DC cables have been connected to the inverter (but disabled by the DC disconnects).
3. AC wiring has been completed (but has been disabled by the AC disconnects).
4. All connections have been checked.

Start-up and Testing procedure can now be performed.

Warning

These procedures are to be performed only by a QUALIFIED INSTALLER.

Inverter Start-up and Testing

1. Place the Inverter ON/OFF switch in the OFF position.
2. Verify that any external AC output circuit breakers are reset.
3. Make certain that the DC and AC sources to the inverter are all disconnected from the inverter via the code required disconnects.
4. Verify that the DC power leads are connected properly to the inverter in the DC raceway.
5. Verify that the AC load and Utility leads are connected to the proper terminals in the AC raceway.
6. Reconnect the DC source via the code required disconnect to the Inverter.
7. With a Voltmeter, verify that the proper input voltage (24 or 48 volts) is present at the Inverter DC IN terminals.

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8. Verify that there is no voltage present on the inverter AC output terminals (between L1 and Neutral).
9. Connect a 120 Volt 75 watt trouble light (or other suitable load) to the inverter AC output (between L1 and neutral) and turn on inverter via the front panel switch.
10. Refer to the description of operation of the indicator lights, in the RE-4500 Owners Manual.
11. If the inverter is not operating as described, see Trouble Shooting Procedures of this document.

Full installation and Start-up

This installation procedure is for the first-time installer (or for someone needing) a more detailed procedure.

Unpacking the Inverter

Inspect the shipping container and equipment for loose or damaged parts. If any damage is found, immediately notify the freight carrier.

Inverter Installation Considerations

- Mounting: Locate a secure, dry, flat vertical surface large enough to mount the inverter (and Accessory modules if used – RE-ACM and RE-DCM). The location should be as close to the battery as possible, usually within six feet, but not in the same compartment and should provide adequate ventilation while the inverter is operating. The location must be clean, dry and free of dripping water, or other moisture contamination.
- Cooling Fan Clearance: The mounting location must allow unobstructed airflow for cooling. Allow a minimum clearance of 12 inches (30.48 cm) on bottom and sides of the inverter. The Cooling Fan is a thermostatically controlled exhaust fan. Air is drawn into the inverter from the intake vents and exhausted by the fan. Obstruction of the fan exhaust or the intake vents will diminish the inverter output capacity due to overheating.

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DC Wiring Considerations

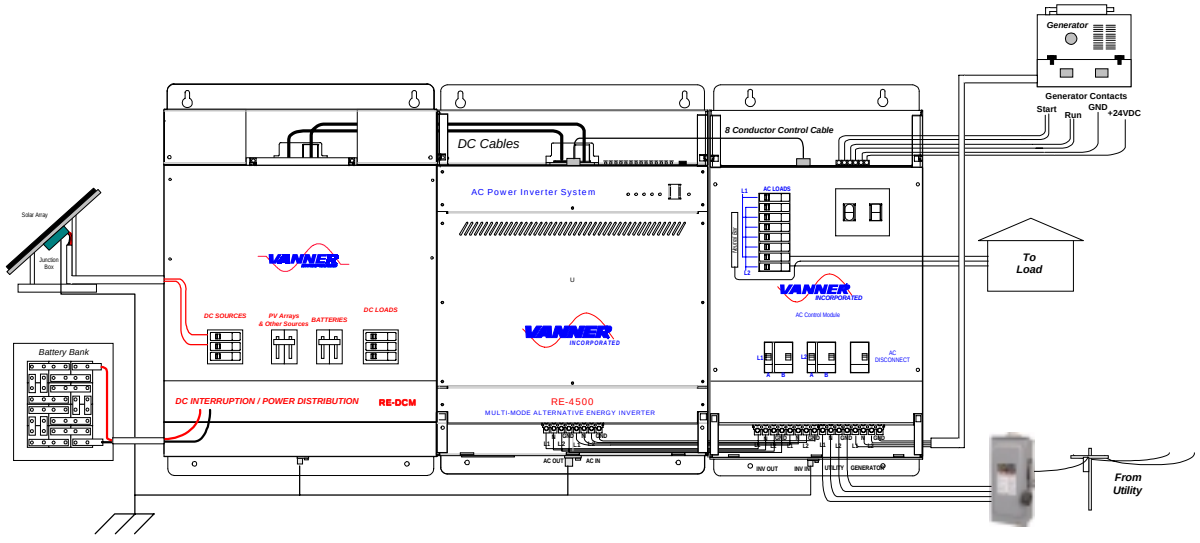
- A DC fuse is REQUIRED to properly protect the inverter in case the battery cables are connected backward (reverse polarity). Use a Vanner Part Number 04095 Very Fast Acting 400 amp fuse.
- The wiring of your inverter installation should conform to the National Electric Code (NEC) and any other state or local codes in effect at the time of installation. These codes have been written for your protection and their requirements should be followed.
- It is recommended by Vanner that you use a DC Control Module which will take care of the majority of NEC code requirements for the DC disconnects and terminations. In the event that the RE-DCM is not used please refer to Figure 3-5.
- Use 75° C copper wire with a class 1 rating for all control-circuit wiring.

Warning

This Diagram is for informational purposes ONLY!!!

Please refer to National, State, and Local Electrical Wiring codes to insure compliance and safety!

F 4 Figure 3-4 RE System Interconnection Diagram



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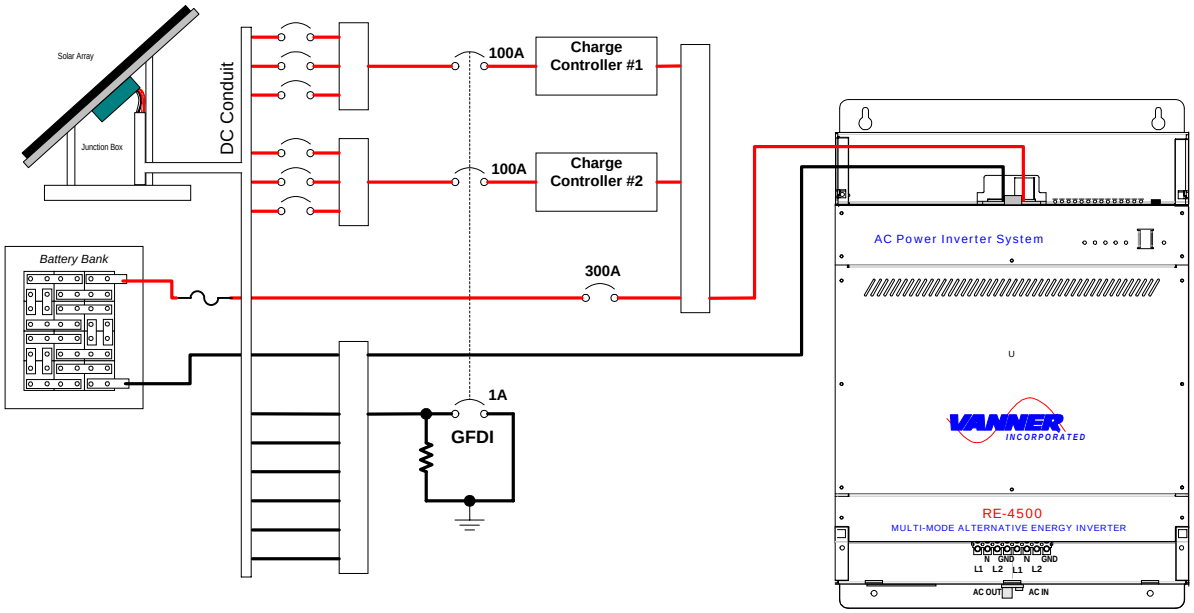
F 5 Figure 3-5: DC Wiring Diagram

DC Control and Distribution Wiring



Warning

It is important to disconnect ALL DC sources to avoid electric shock!

DC Voltage is extremely dangerous and contact with DC Currents can lead to injury, damage to property, and death!

Use the DC disconnect to insure that ALL potentials are disabled.

1. Route the DC power wiring and AC output wiring with as much physical separation as possible from low voltage wiring such as audio and video signal wires.
2. Route the DC positive and negative cables as close together as possible and use cable ties to keep them together. This reduces electromagnetic radiation that could interfere with sensitive electronics.
3. If passing through steel or other ferrous metal walls, the DC input cables need to pass through the same hole to prevent causing a transformer effect. If two holes are

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required, cut a slot to connect the two holes to prevent heating of the ferrous metal.

4. If passing through any sort of holes, make certain that strain reliefs are used to avoid cutting or abrasion of insulation over time.
5. Proper DC cable size is critical for the performance and safe operation of the inverter system. It is required by Vanner that the installer use 4/0 AWG wire to minimize losses to less than ½ volt over the length of the cable. This wire needs to be rated for 90ºC.
6. DC cables should be as short as possible to minimize losses.
7. The DC power connections to the inverter require that 5/16" Dia. ring terminals be used for connection to the inverter unless the optional mechanical compression blocks (Vanner P/N D08421) are used. A list of suitable terminals as well as the tools required to crimp them are shown in Table 3-1: Ring Terminals for 4/0 DC Cables.

Table 3-1: Ring Terminals for 4/0 DC Cables

UL Listed Ring Terminals for 4/0 DC Cables

Molex Part Number	Size	Model	Crimping Tool Part Numbers
L-395-56	5/16" DIA.	Versacrimp	DLHH, PPDLH,SKT-840*
L-995-56		Nylacrimp	

*This tool is for crimping Versacrimp style terminals only.

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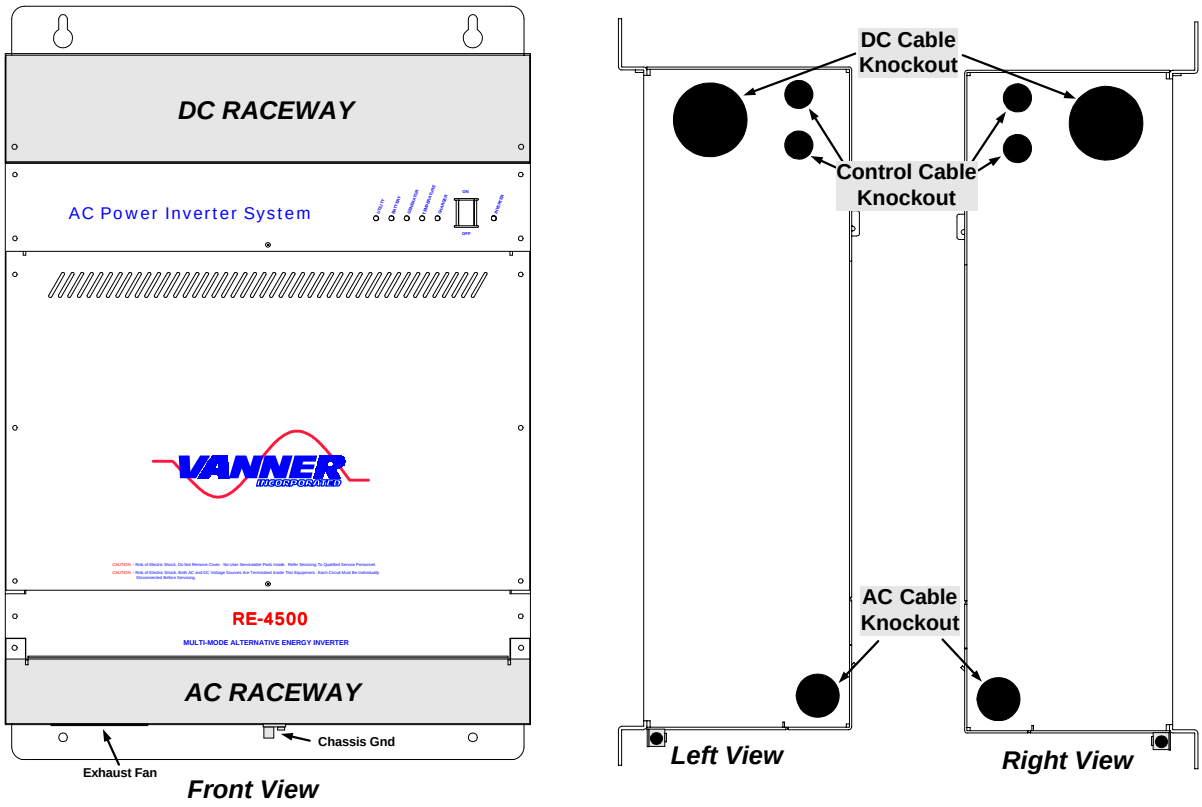
DC Wiring Installation Procedure

The DC wiring raceway is located at the top of the inverter (Figure 3-6). The DC cables may enter the inverter through the left or the right side openings to the raceway (Figure 3-6). Conduit knockouts are provided. Bolts and spring washers are provided for connecting 5/16” diameter ring terminals to the DC Input Contacts. Optional compression lugs (Vanner part no. D08241) are available for cables sizes up to 250 MCM.

F 6 Figure 3-6: Inverter System



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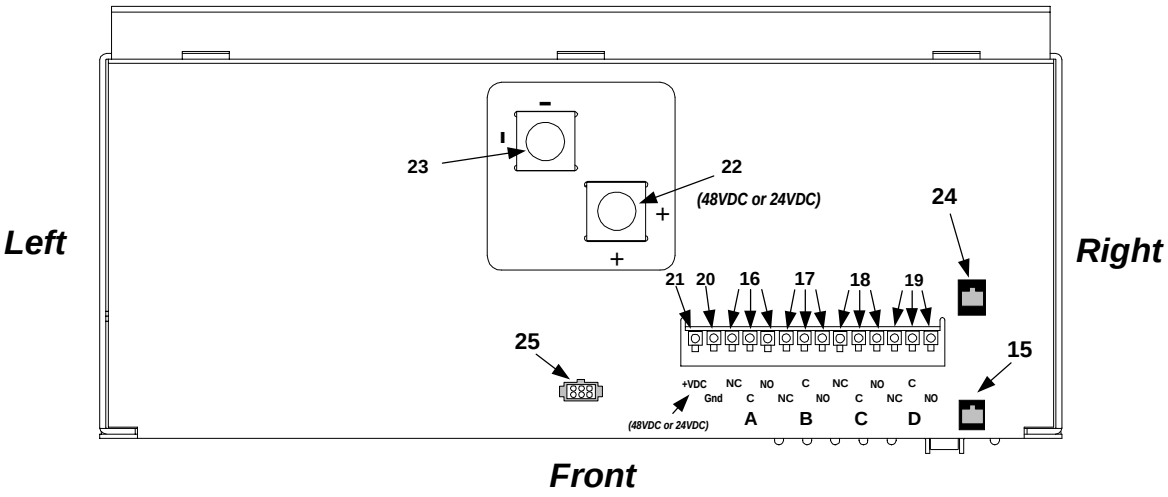
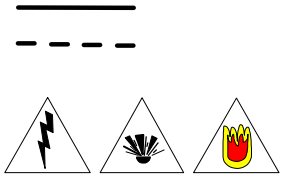
F 7 Figure 3-7: Inverter DC Raceway Terminations



1. Select a location for the inverter. An ideal location is close to the battery; protected from weather and moisture; and well ventilated.



Warning

It is important to disconnect ALL DC sources to avoid electric shock!

DC Voltage is extremely dangerous and contact with DC Currents can lead to injury, damage to property, and death!

Use the DC disconnect to insure that ALL potentials are disabled.

2. Select an accessible location for the DC Fuse. The location should be within 18” of the battery and accessible for visual inspection and replacement. If possible locate so the last DC connection can safely be made at the fuse.
3. Remove the cover plate on the DC cable raceway to expose the positive and negative DC connections.
4. Prepare DC cable ends. Use ring terminals or, if using the optional D08241 Compression Lugs, leave the cable ends bare.
5. Verify that the DC cables are still disconnected from the DC Source.

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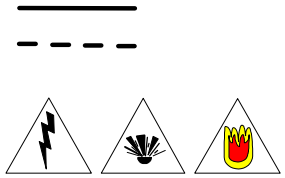
6. Insert the DC cables through the appropriate knockout and into the DC wiring raceway.
7. Torque the DC cable mounting bolts to 105 inch pounds. Re-torque after 30 days.
8. Inspect the DC cable compartment to be sure no copper wire fragments are present after tightening cables.
9. Route the negative DC cable to the DC source disconnect (or Vanner DCM). Verify cable polarity before proceeding.



Warning

If the cables are reversed, the fuse will be blown and inverter can be damaged.

10. Route the positive DC input cable to the DC disconnect. Protect cables with loom and use grommets or other appropriate means where cables may contact hard, sharp edges. If possible, make the last DC connection at the disconnect to avoid causing a spark at the battery.
11. If any of the control NC or NO outputs need to be wired, for control of external devices, do so at this time.
12. Route the control NC or NO wiring with as much physical separation as possible from low voltage wiring such as audio and video signal wires, the Input DC wiring, and AC wiring. This is accommodated in the system through the physical separation of the High Current DC knockouts and the Control knockouts for the DC Raceway.
13. Verify that the control NC or NO wiring is still disconnected from the device to which they are to be attached.
14. Insert control NC or NO wiring through the knockout and into the DC wiring raceway.
15. Connect the NO, NC, Common, and +24VDC and GND to the appropriate terminals in the terminal strip and torque each of the AC terminal screws to 4 inch pounds. Re-torque after 30 days.
16. Verify DC wiring installation. Verify that all connections are tight. Secure all wiring and replace the DC Raceway cover.

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17. Verify that the inverter will turn ON but do not leave the inverter connected to the DC source(s) at this time (turn off the DC disconnect). Final DC connections will be made after all control and AC output installation issues have been inspected.

AC Utility/Load Wiring Installation Procedure

Warning

Before proceeding with the AC wiring, verify that the inverter is OFF and that the inverter is NOT connected to the battery. Serious or fatal electrical shock may occur.

Please refer to Figure 3-9 if the RE-ACM is not used in this installation. Please refer to Figure 3-6 for the location of the AC Raceway. Please refer to Figure 3-10 for location of the AC Raceway and terminations.

It is recommended by Vanner that you use an AC Control Module which will take care of the majority of NEC code requirements for the AC disconnects and terminations.

Note: **It is required that all AC wiring be done with 10 AWG 90ºC wire. Make certain that the wiring conforms to National and Local Electric Codes.**

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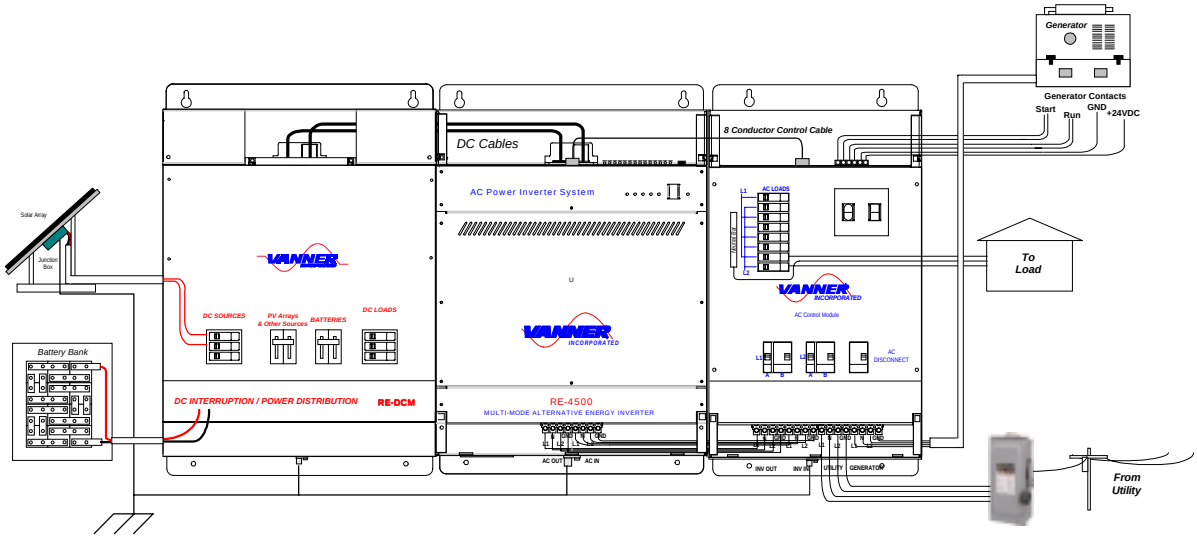
Warning

This Diagram is for informational purposes ONLY!!! Please refer to National and Local Electrical Wiring codes to insure compliance and safety!

Warning

External Output Overcurrent Protection Must Be Provided By Using A 40 A Circuit Breaker (Maximum).

F 8 Figure 3-8 RE System Integration



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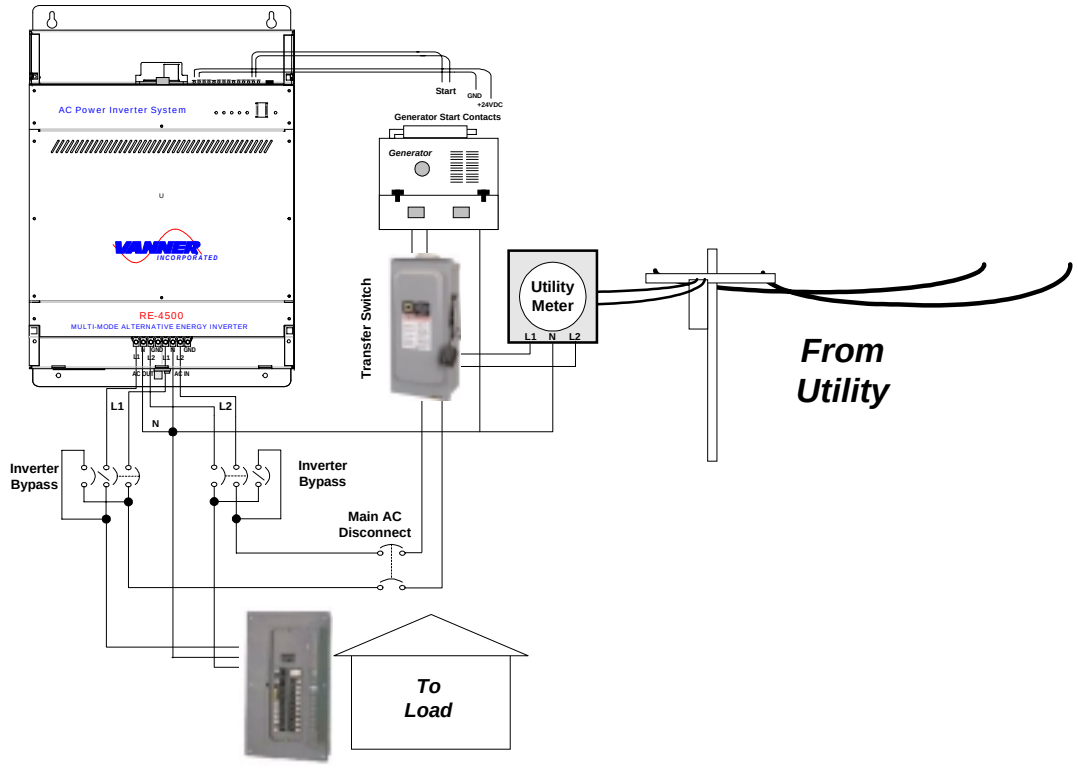
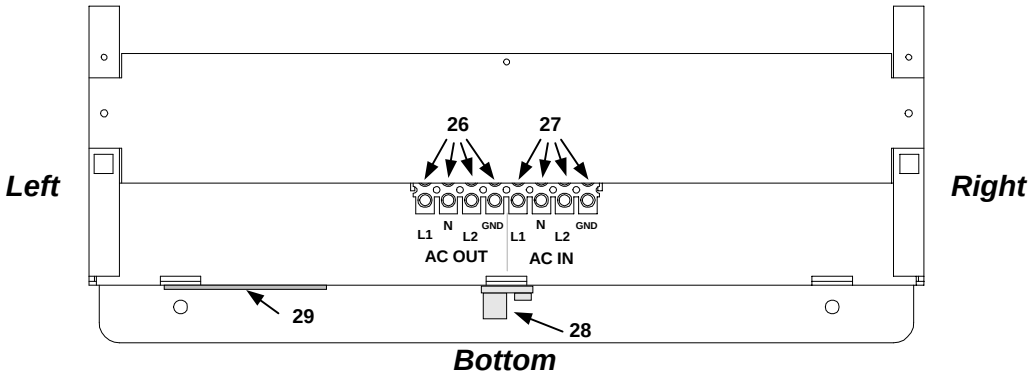
F 9 Figure 3-9: AC Wiring Diagram



AC Control / Distribution Wiring

F 10 Figure 3-10: Inverter AC Raceway Terminations



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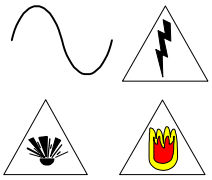

Warning

It is important to disconnect ALL AC sources to avoid electric shock!

AC Voltage is extremely dangerous and contact with AC Currents can lead to injury, damage to property, and death!

Use the AC disconnect to insure that ALL potentials are disabled. Use a lockout to insure that voltages are not inadvertently reconnected.

Note

It should be noted that the RE-4500 does not require the rewiring of Multiwire branch circuits since it is a true 3 wire 240 Vrms output.

1. The wiring of your inverter installation should conform to the National Electric Code (NEC) and any other state or local codes in effect at the time of installation. These codes have been written for your protection and their requirements should be followed.
2. Remove the bottom cover (for the AC Raceway) to expose the AC wiring compartment and the AC Utility and Load Wiring Terminal Block. Input and Output Circuits for L1 and L2 are identified on the terminal block label and are defined in Figure 3-10.
3. Route the AC output wiring with as much physical separation as possible from low voltage wiring such as audio and video signal wires, and the Input DC wiring. This is accommodated in the system through the physical separation of the AC and DC wiring raceways.
4. Verify that the AC utility cables are still disconnected from the AC Utility (or Vanner ACM).
5. Insert AC utility cables through the knockout and into the AC wiring raceway.
6. Connect L1, N, L2 and ground to the appropriate terminals in the terminal strip and torque each of the AC terminal screws to 15 inch pounds. Re-torque after 30 days.
7. Verify that the AC output cables are still disconnected from the AC load (or Vanner ACM).
8. Insert AC utility cables through the knockout and into the AC wiring raceway.

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9. Connect L1, N, L2 and ground to the appropriate terminals in the terminal strip and torque each of the AC terminal screws to 15 inch pounds. Re-torque after 30 days.
10. Use the Chassis Ground compression fitting (28) to ground the chassis using 10 gauge wire. Connect the chassis ground wire to the compression fitting and torque the bolt to 75 inch pounds. Re-torque after 30 days.
11. Verify AC wiring installation. Verify that all connections are tight. Secure all wiring and replace the AC Raceway cover.

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Start-up and Test Procedure

After the inverter has been properly mounted with sufficient ventilation, verify the following:

1. DC cables have been connected to the inverter and to the DC Disconnect
2. DC cable polarity is correct.
3. The DC Disconnect is still in the OFF position (no voltage present at output of the Disconnect)
4. AC Disconnect is in the OFF position (no voltage present on the output of the Disconnect).
5. AC wiring has been completed
6. AC phase and connections are correct
7. All remote connections have been checked.

The Start-up and Testing procedures can now be performed.

Warning

These procedures are to be performed only by a QUALIFIED INSTALLER.

Inverter Start-up and Testing

1. Place the Inverter ON/OFF switch in the OFF position.
2. Verify that any external AC output circuit breakers are reset.
3. Connect the DC source via the code required disconnect to the Inverter.
4. With a Voltmeter, verify that 24VDC is present at the Inverter DC IN terminals.
5. Verify that there is no voltage present on the inverter AC output terminals (between L1 and Neutral).
6. Connect a 120 Volt 75 watt trouble light (or other suitable load) to the inverter AC output (between L1 and neutral) and turn on inverter via the front panel switch.

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7. Refer to the description of operation of the indicator lights, in Indicator Lights on page 3-16.
8. If the inverter is not operating as described, see Trouble Shooting Procedures on page 5-2.

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4 System Setup

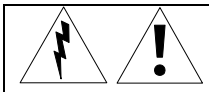
System Control and Setup

This section describes the Control of the RE-4500. The controls set consists of an On/Off switch and the Inverter/Charger Controller.

If more information is needed, please refer to the RE-4500 Owners Manual.

On/Off Switch

The On/Off switch located on the front panel, turns on and off the internal logic power supply. This switch also when placed in the “Off” position resets the system.



Warning

It should be noted that dangerous voltages are still present inside the RE-4500.

Disconnect all DC and AC Power Sources from the RE-4500 before attempting any service of the unit.

There are no User Serviceable Components inside the RE-4500!!

Inverter/Charger Controller

This section describes the operation of the Inverter/Charger Controller which is shown in 4-11. The RE-ICC is used to communicate commands and get status from the RE-4500. It enables the user to command the system from a system of menus which control different aspects of the RE’s operation.

Warning

The Factory Default Settings the unit is shipped with should only be

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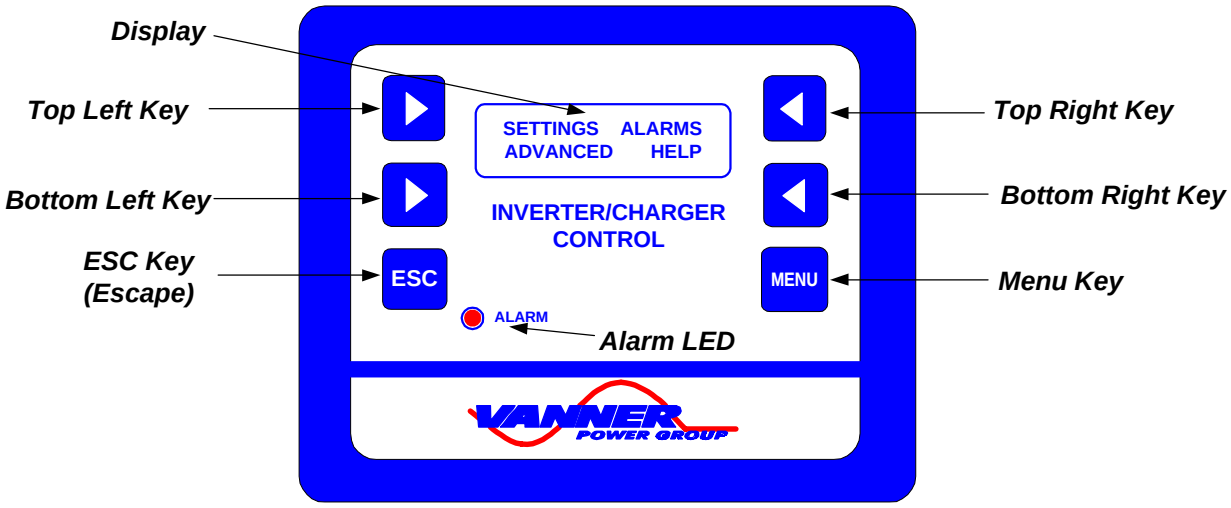
	changed by a Vanner Certified Installer or by Authorized Factory Personnel. There are no field adjustable Trip Points. All of these Trip points are password protected to avoid incorrect entries.

⚠	**Warning** **Wrong settings can damage the unit, and lead to personal injury or death, and voiding of the manufacturers warranty.**

F 11 Figure 4-1: Inverter/Charger Controller



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Display and Key Functions

The features and functions of the RE-ICC are:

(1) Display

Used to display Menu selections, Data Entry Fields, Status Messages

(2) Top Left Key

Selection of menu items or scrolling up through the menu

(3) Bottom Left Key

Selecting a displayed item, increasing (Incrementing) display items, Selecting an “ON” or “YES” function

(4) ESC Key

ESC (Escape) key is used to “back up” to the next higher menu and/or to cancel new data being entered.

(5) Top Right Key

Selection of menu items or scrolling down through the menu

(6) Bottom Right Key

Selecting a displayed item, decreasing (decrementing) display items, selecting an “OFF” or “NO” function.

(7) Menu Key

If a Menu is available for a displayed item, this key when depressed moves the display to the new menu.

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LCD Contrast Control

An additional feature for the **LCD** (**L**iquid **C**rystal **D**isplay) version of the RE-ICC is a contrast control. By holding down the **ESC** key and pressing either the **Top Right Key** (to make the display lighter) or the **Bottom Right Key** (to make the display darker), the contrast can be adjusted.

Note:	**This adjustment for the contrast only works with the LCD type display! The VFD (Vacuum Fluorescent Display) is unaffected by this control.**

Moving Around the RE-ICC Menus

First of all, "Don't Panic".

Moving around the Inverter/Charger Controller can be a little difficult at first, but with a little practice, it will become very easy! This section contains examples to help the first time user figure out how to enter data and move around the menus.

Warning

This Section contains examples to help the user get started with the RE-4500 system. It is assumed that the Inverter has been properly installed at this point.

If the RE-4500 has not been installed, please refer to either the quick installation or the Full Installation sections of this manual before proceeding.

The RE-ICC Menus consist of the following menus:

Main Menu	Root Menu, this is the start menu from which everything can be accessed.
Display Menu	Displays status, voltages, current, frequency, etc. for the RE-4500
Settings Menu	Turns on/off and adjusts functional parameters for the RE-4500 -mostly used for installation.
Advanced Menu	Adjusts more advanced features dealing with communication, calibration, password level, debugging.

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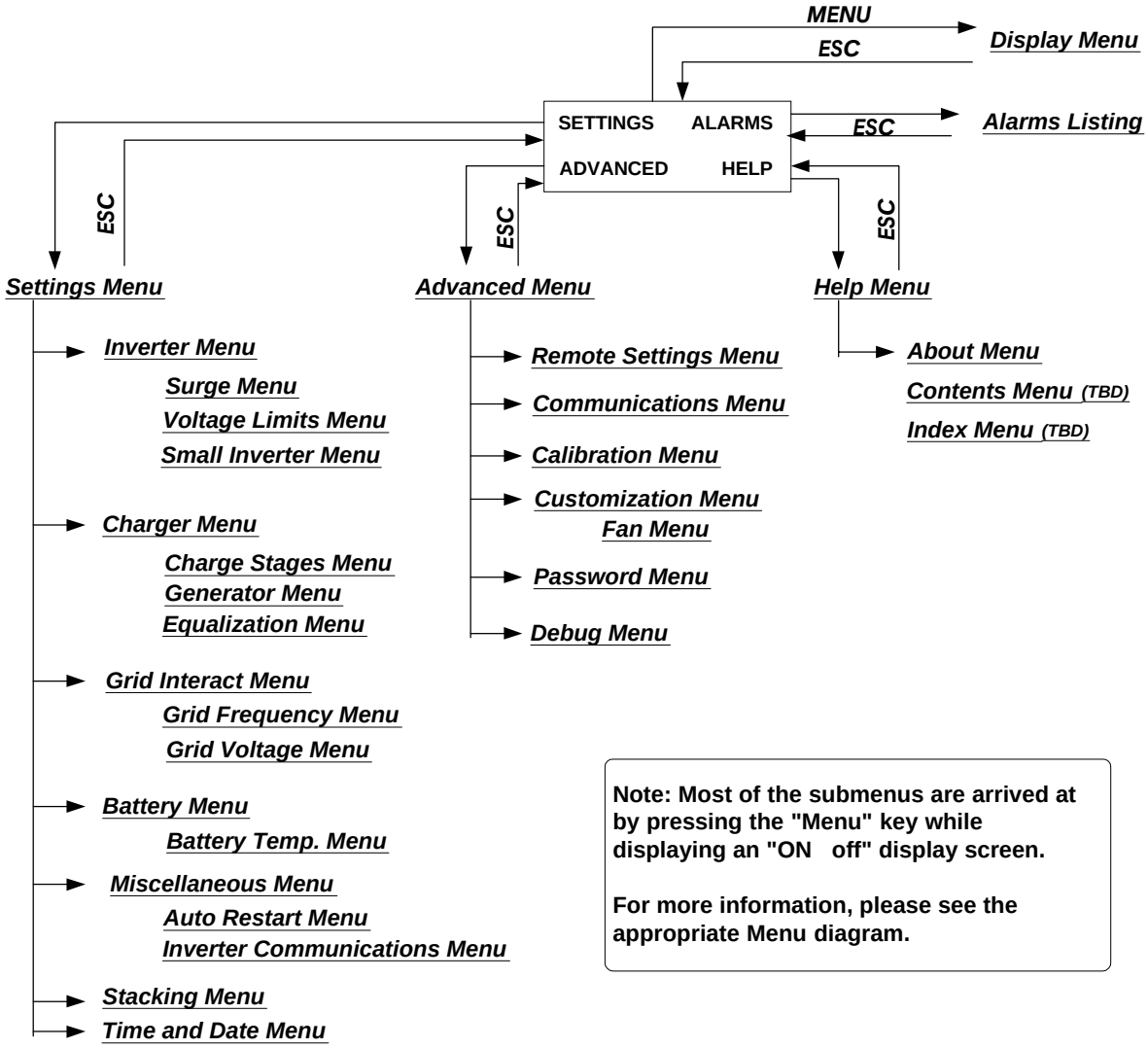
Help Menu — Gives Version level, Help, and Index menus.

Alarm Menu — Displays status messages for the RE-4500, automatically scrolls through the listing of active alarms. See Alarm Listing in Appendix C: Settings.

F 12 Figure 4-2: RE-ICC Menus



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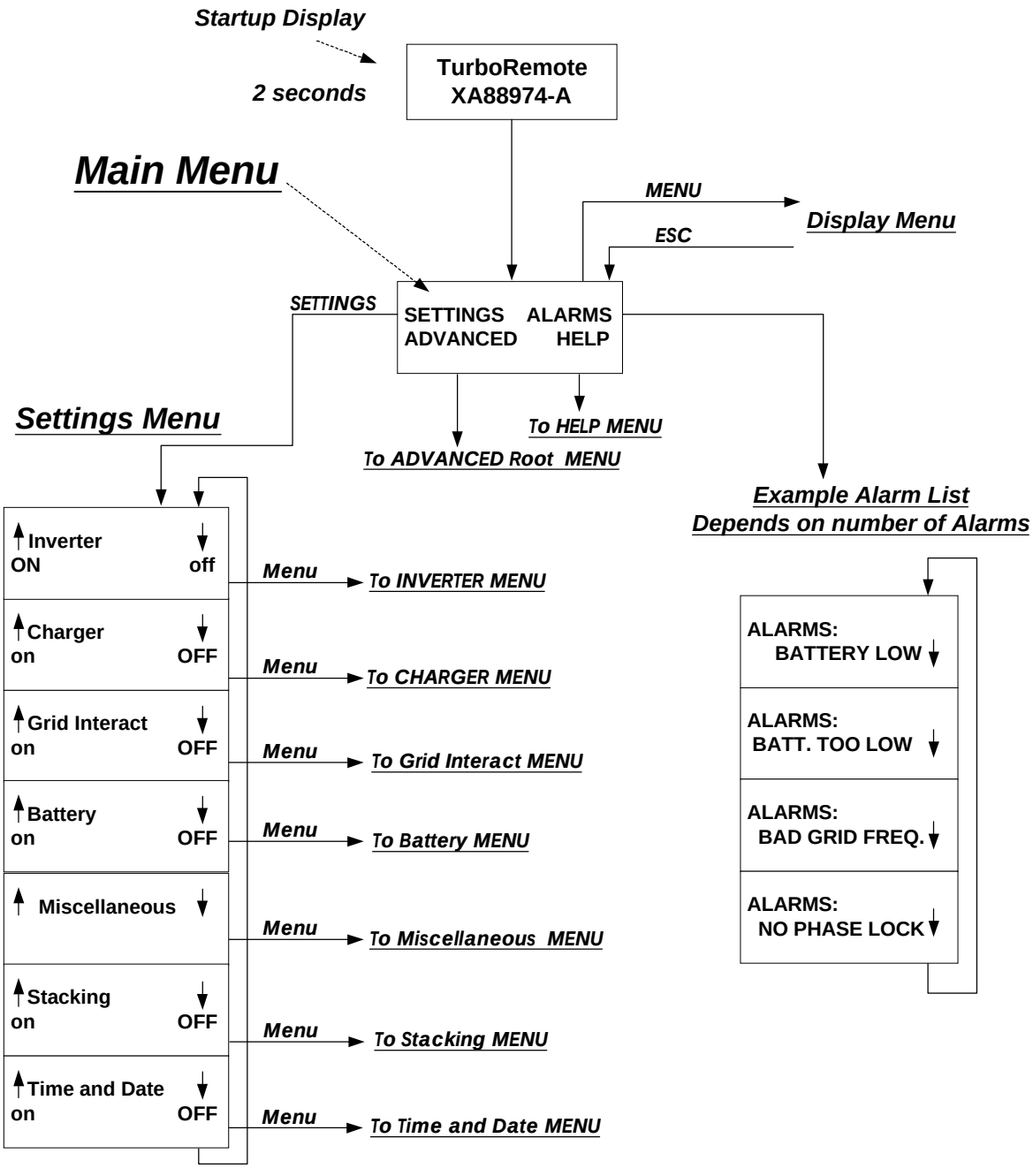
F 13 Figure 4-3: Main Menu



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1. Press the Top Right Key next to the ↓ symbol. This will move you to the next menu item.

   The Display will change to

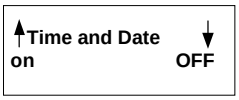
2. Keep pressing the Top Right Key next to the ↓ symbol. You will see that each time you press the key that the screen will advance down the list in Figure 4-3.

   Note: If you hold the ↓ key down the menu items will scroll DOWN rapidly.

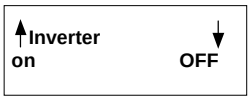
3. Try pressing the Top Left Key next to the ↑ symbol. You will find that the each time you press the key that the screen will advance up the list in Figure 4-3.

   Note: If you hold the ↑ key down the menu items will scroll UP rapidly.

4. You will also notice that this menu "wraps around". In other words, when you get to the bottom of the list

   the next screen to show up will be the "Inverter on OFF" screen, bringing you back to the top.

   Likewise the same thing happens with the ↑ arrow. The Menu will wrap around with the next item above the Inverter screen being the Time and Date screen.

   As you look at Figure 4-3, you will notice that the many of the screens have additional menus that can be accessed from them.

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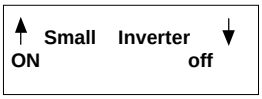
5. If you are not at the “Inverter on OFF” screen, go to it now and press the “MENU” button. You will now be at a new screen.



You are now at the first item in the INVERTER Menu. The Inverter Menu structure is shown in Figure 4-4. As you can see, you have a lot of options of where to go from here!

6. Press the ESC key. This will take you back to the SETTINGS Menu. The Display should look like the following:

7. Press the ESC key again. This will take you back to the Main screen shown below:

8. Press the Bottom Left key next to ADVANCED (this will take you to the Advanced Menu (Figure 4-5)).

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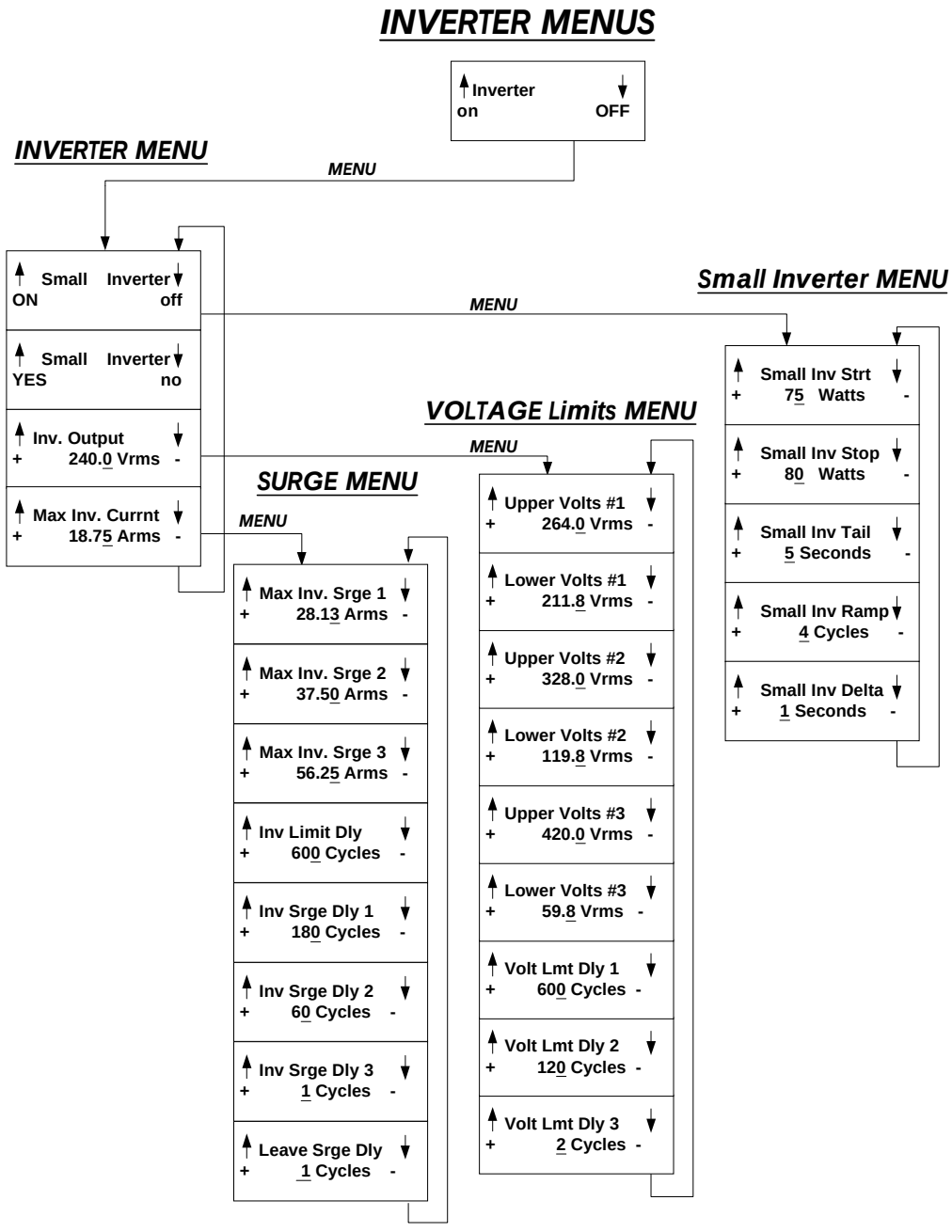
F 14 Figure 4-4 Inverter Menu



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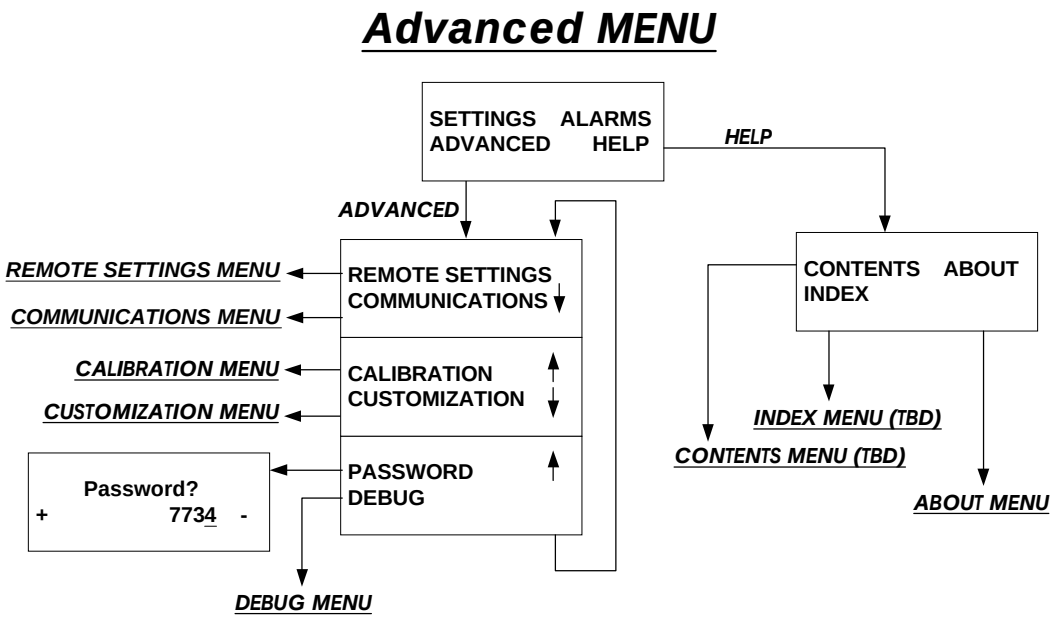
F 15 Figure 4-5: Advanced Menu



9. Press the Bottom Right key next to the "↓" symbol. This will take you to the screen shown below.

10. Press the Bottom Right key next to the "↓" symbol again. This will take you to the screen shown below.

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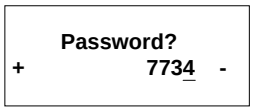
11. Next, press the Top Left key next to “Password”. This will take you into the Password Menu. The screen shown below should now appear.



This Password system is used for allowing (or not allowing) changes to RE parameters (for more information on the PASSWORD function, refer to Changing the Password Settings on page 4-13.

12. Press the Bottom right button near the “–“ symbol.

    You will see the 7734 change to 7733 and continue going down. You will notice that the longer you hold the “-“ key down, the faster the Password setting will go down.

    As the speed increases, the underline will move to the left. If you release the key, and then press it again, the underline will move to the far right again.

13. Take the Password down to 5000 exactly.
14. Use the Lower Left Key next to the “+” sign if you need to increase the Password Number.
15. Next return the Password to 7734 using the keys next to the “+” and “-“ keys.
16. Press ESC.

    This returns you to the PASSWORD DEBUG Menu.

17. Press ESC again.

    This returns you to the Main Menu.

Congratulations! You now know how to navigate the menus and change data!

For further information on menu items please refer to Appendix B: RE-ICC Menus. This section has the complete menu structure for the RE-ICC.

Additional Entry Methods

There are a couple of other entry methods that need to be discussed. Refer to the menus in Appendix B: RE-ICC Menus and find the Equalization Menu (a submenu of the CHARGER menu).

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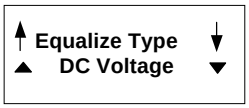
In the EQUALIZATION Menu there is a screen that looks like the following:



The "▲" and "▼" symbols mean that there are additional selections that may be made for this menu item. In this case (as shown in the CHARGER Menu in Appendix B: RE-ICC Menus the selections are DC POWER, DC CURRENT, and DC VOLTAGE.

Since entry "DC VOLTAGE" is at the bottom of the list, the Lower Left Key should be used to move up through the list. Likewise the Lower Right Key should be used if you need to scroll down through the list.

There is one more menu item that needs explained. That is the Charge Stage Name shown in the Charge Stages Menu shown below:

In this menu the "►" and "▲" symbols are used. The Lower Left Key (►) is used to change the position selected by the cursor while the Lower Right Key (▲) changes the selected character to a new character.

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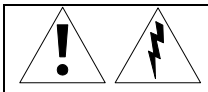
Changing the Password Settings

This Section will show you how to change the password.

Access to the Inverter/Charger Controller has three levels of access.

- **User** – (7734) This level of access allows viewing of all the menu items and some limited adjustment of parameters, but no adjustment to the more advanced parameters. Changes are limited to the following list.
    - Settings Menu

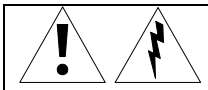


Warning

Changes to the menu items at the Installer Level of Access or higher should only be done by Vanner Authorized personnel. Failure to follow proper procedures and configurations can lead to death, explosion, electrocution, loss of property and equipment, and voiding of warranty!

- **Installer** – (43575) This level of access allows the more advanced parameters associated with the installation of the system to be changed.

  As with the User level, all menu items can be accessed, but not necessarily changed. Changes can be made to all the changeable items in the User level, but also include the following additional menus:
    - Equalization Menu
    - Generator
    - Charger Menu
- **Factory** – This level of access allows unlimited changes to all items in the complete menu structure. These items should only be modified by Vanner Factory Personnel.



Warning

Changes to these menu items should only be performed by Vanner Authorized Factory Personnel! Wrong configurations can lead to death, damage to equipment, and voiding of the warranty.

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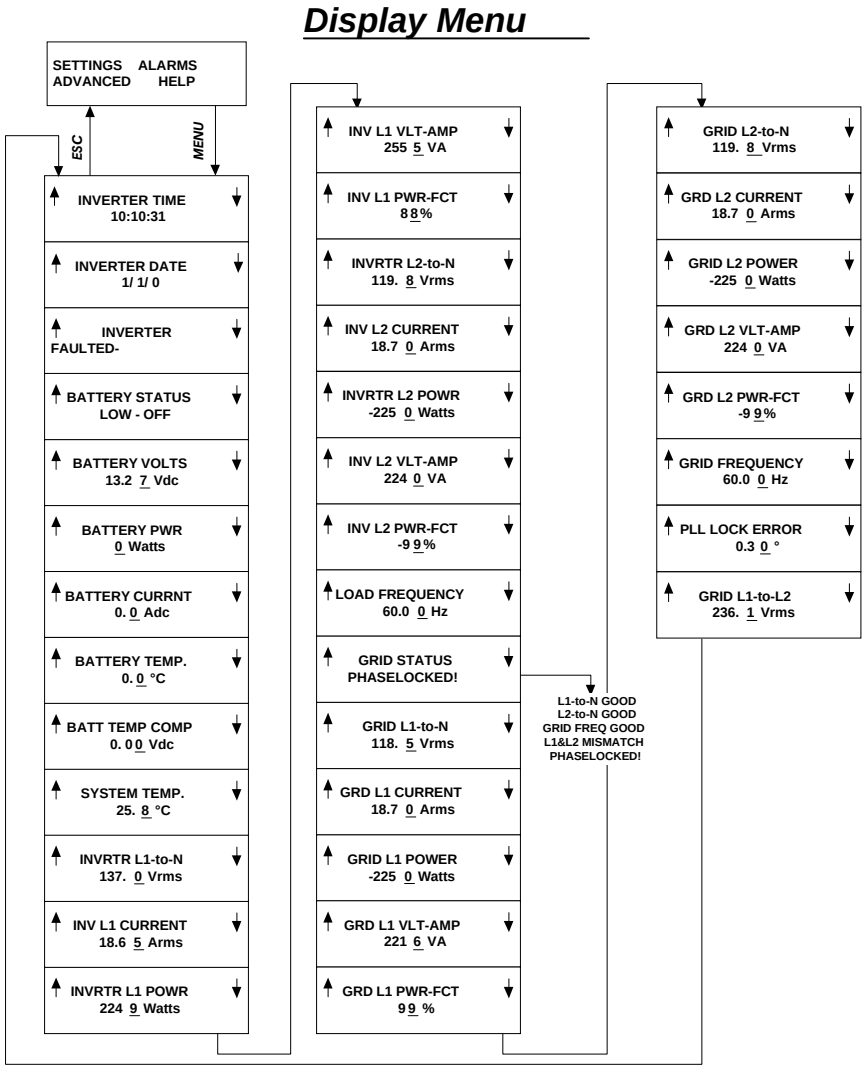
Display Menu

This Menu is accessed by pressing the “Menu” button when at the Main Menu. This will bring up the menu shown in Figure 4-1: Display Menu. This menu can be used to display status of voltages, currents, power, temperature, or many other monitored status items associated with the RE-4500. The “ESC” key will take you back to the Main menu.

Figure 4-1: Display Menu



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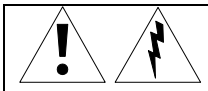
Charger Setup

The following sections will give an example in how to set up the Charger menus of the inverter. The first example is for a 3 step charging cycle, and the second is for a 7 step charging cycle (The factory setting).

It is recommended that the user be familiar with the operation of the ICC (Inverter/Charger Controller) before attempting the Charger Setup examples shown below. Please refer to the RE Owners Manual for more information on the ICC.

It should be noted that the examples in this document are for the RE24-4500 Inverter.



Note

It should be noted that the examples in this document are for the RE24-4500 24 VDC Inverter. To get the DC values of voltage settings for the RE48-4500 48 VDC Inverter, multiply the DC voltage settings by 2, and divide the DC current settings by 2.

If you have any questions on this subject call 1-800-ACPower.

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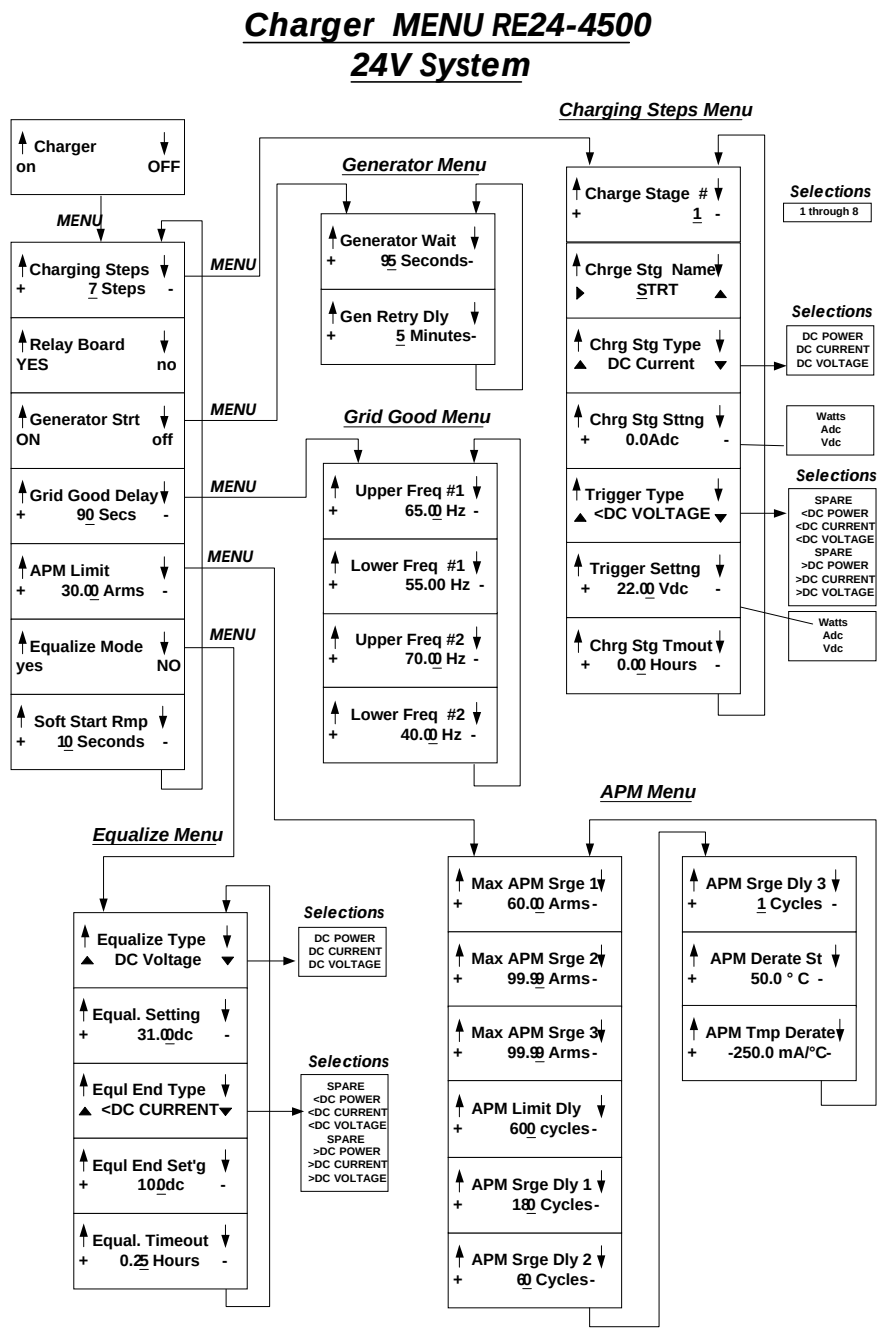
Figure 4-6 shows the Charger Menu for reference.

F 16 Figure 4-6: Charger Menu



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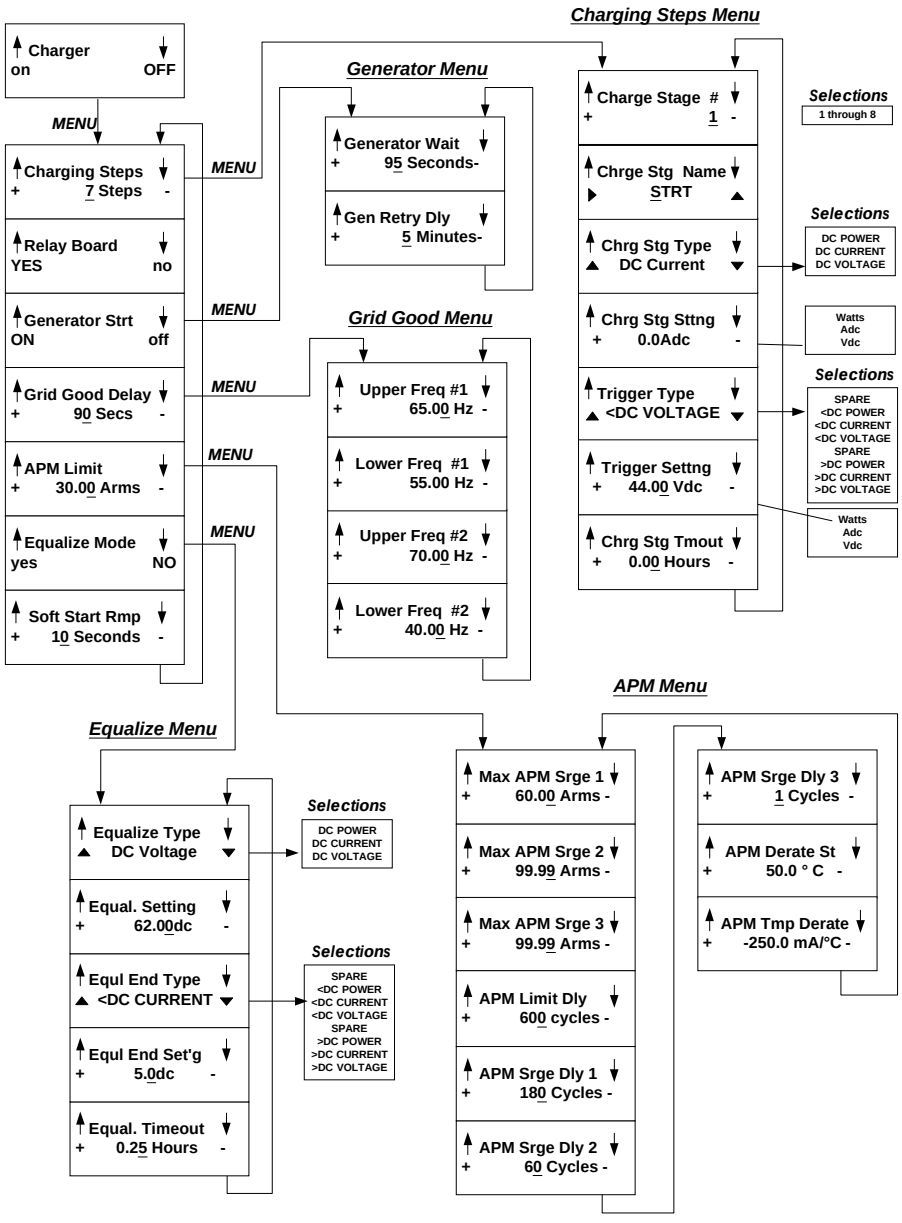
Charger MENU RE48-4500
48V System



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NOTE

It should be noted that the RE-4500 is shipped with the Factory Settings for flooded-cell, lead acid type batteries.

Warning

Please refer to the manufacturers data sheets for setting up the appropriate set points for voltage and current for your charging system. Failure to do so could cause damage to your batteries and/or reduction in their life. Wrong settings could also cause other damage to the system and voiding of your manufacturer's warranty.

Example 1 – 3 Step Charging Cycle

This section will assist you in setting up the charger. The example shown below is for a 3-stage bulk charge sequence for a flooded battery system. Please consult the Battery manufacturer's recommendation for any additional setpoints and charging steps for your type of battery.

1. Go through the charger menu as shown in Figure 4-6 and set "Charging Steps" to 3. Then hit the MENU key to go into the charging steps menu.
2. Perform the first set of charging steps:
   a. Set "Charge Step #" to 1. (The first charging step). Press the Top Right Key.
   b. For the time being, leave "Charge Stage ," the charge step name, whatever it is, "STRT?" Again, Press the Top Right Key.
   c. Choose the "Charge Type" to be "DC CURRENT." Press the Top Right Key.
   d. Make the "Charge Setting" "0.0 Adc." Press the Top Right Key.
   e. Choose the "End Chrg Type" to be "<DC VOLTAGE. " Press the Top Right Key.
   f. Next set the "End Chrg Set'g" "22.00 Vdc" (***44 V_{DC}*** *for the RE48-4500*) or whatever voltage you want the batteries to deplete to before charging. Press the Top Right Key

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g. And last, set "Charge Timeout" to "0.00 Hours." Press the Top Right Key to take you back to “Charge Step #”.

This charge step is a placeholder where nothing really happens to the batteries until their voltage falls and they truly do need a charge. At that point, the inverter charges the batteries at 0 Adc until the battery voltage falls below 22.0 Vdc, and then goes on to the next charging step.

3. Perform the second set of charging steps:

   a. Set "Charge Step #" to 2. (The second charging step) Press the Top Right Key.

   b. Leave "Charge Stage " whatever it is, "BLKC?" Press the Top Right Key.

   c. Choose the "Charge Type" to be "DC CURRENT." Press the Top Right Key.

   d. Make the "Charge Setting" "100.0 Adc." (+100.0) (***50 A_{DC}*** *for the RE48-4500*) Press the Top Right Key.

   e. Choose the "End Chrg Type" to be ">=DC VOLTAGE." Press the Top Right Key.

   f. Next make the "End Chrg Set'g" "27.20 Vdc" (***54.4 Vdc*** for the RE48-4500) or whatever voltage is correct for your battery bank. Press the Top Right Key

   g. And last, set "Charge Timeout" to "24.00 Hours". Press the Top Right Key to take you back to “Charge Step #”.

   During this charging step the inverter will put 100 Adc (***50 A_{DC}*** *for the RE48-4500*) into the batteries until their voltage has risen to 27.20 Vdc (***54.4 Vdc*** *for the RE48-4500*) (or until 24 hours have gone by) and then the inverter will go on to the next charging step.

4. Perform the third set of charging steps:

   a. Set "Charge Step #" to 3. (The third and last charging step) Press the Top Right Key.

   b. Leave "Charge Stage " whatever it is, "BLKV?" Press the Top Right Key.

   c. Choose the "Charge Type" to be "DC VOLTAGE." Press the Top Right Key.

   d. Make the "Charge Setting" "27.20 Vdc," (***54.4 Vdc*** *for the RE48-4500*) the ending voltage of your last step. Press the Top Right Key.

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e. Choose the "End Chrg Type" to be "<DC CURRENT." Press the Top Right Key.

f. Next make the "End Chrg Set'g" "20.0 Adc" (***10 A_{DC}*** *for the RE48-4500*) or whatever ending current is correct for your battery bank. Press the Top Right Key.

g. And last, set "Charge Timeout" to "24.00 Hours." Press ESC to go back up the menu.

During this final charging step, the inverter will hold the battery bank at the voltage setting until the battery current falls to less than the setting or until a day has gone by. The inverter will then go back to the FIRST step, and start over.

Example 2 – 7 Step Charging Cycle

This example is for the factory setting 7 step charging steps.

This 7 step charging cycle is a 7-stage bulk charge for flooded lead acid batteries (similar to the Vanner Incorporated TruSine TSC24-4500).

To change or review the setpoints, use the ICC remote to go up to the charger menu and look at "Charging Stges." The Charging Stages factory setting is 7 meaning there are 7 stages or steps the inverter performs when charging the batteries. Hit the MENU key to bring up the charging steps menu.

1. Perform the first set of charging steps:

   a. Use the remote to set "Charge Step #" to 1. (The first charging stage) Press the Top Right Key.

   b. "Charge Stage ," the charging stage name, is "STRT," obviously standing for "start". Press the Top Right Key.

   c. The "Charge Type" is "DC CURRENT," or current into or out of the battery. Press the Top Right Key.

   d. The "Charge Setting" is "0.0 Adc," meaning nothing will happen. Press the Top Right Key.

   e. The "Trigger Type" is "<DC VOLTAGE," meaning the inverter charger will leave the first charging stage when the battery voltage is less than some number. Press the Top Right Key.

   f. The "Trigger Settng" is "22.00 Vdc," (***44 V_{DC}*** *for the RE48-4500*) the voltage you want the batteries to

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deplete to before charging starts. Press the Top Right Key.

g. And last, the "Charge Timeout" is "0.00 Hours." Press the Top Right Key to take you back to “Charge Step #”.

This first charge step is kind of a placeholder where nothing really happens to the batteries until their voltage falls off and they truly do need a charge. That is, the inverter charges the batteries at 0 Adc until the battery voltage falls below 22.0 Vdc (***44 V_{DC}*** *for the RE48-4500*) and then goes on to the next charging stage.

2. Perform the second set of charging steps:

   a. Set "Charge Step #" to 2. (The second charging stage) Press the Top Right Key.

   b. The "Charge Stage " is "BLKC" standing for bulk charge current. Press the Top Right Key.

   c. The "Charge Type" is "DC CURRENT." Press the Top Right Key.

   d. The "Charge Setting" is "100.0 Adc." (+100.0) (***50 A_{DC}*** *for the RE48-4500*) Press the Top Right Key.

   e. The "Trigger Type" is ">=DC VOLTAGE." Press the Top Right Key.

   f. The "Trigger Settng" is "28.40 Vdc." (***56.8 V_{DC}*** *for the RE48-4500*) Press the Top Right Key.

   g. And last, the "Charge Timeout" is "24.00 Hours." Press the Top Right Key to take you back to “Charge Step #”.

   During this second charging stage, the inverter/charger will provide 100 Adc into the batteries. The Inverter will continue to do this until the battery’s voltage has risen to 28.40 Vdc, or until 24 hours have gone by and then the inverter goes to the next charging stage.

3. Perform the third set of charging steps:

   a. Set "Charge Step #" to 3. (The third charging stage) Press the Top Right Key.

   b. The "Charge Stage " is "BLKV" standing for bulk charge voltage. Press the Top Right Key.

   c. The "Charge Type" is "DC VOLTAGE." Press the Top Right Key.

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d. The "Charge Setting" is "28.40 Vdc" (***56.8 V_{DC}*** *for the RE48-4500*) the same as the end point of the last stage. Press the Top Right Key.

e. The "Trigger Type" is "<DC CURRENT." Press the Top Right Key.

f. The "Trigger Settng" is "55.0 Adc." ***(27.5 Adc*** *for the RE48-4500)* Press the Top Right Key.

g. And last, the "Charge Timeout" is "1.00 Hours." Press the Top Right Key to take you back to “Charge Step #”.

During this third charging stage, the inverter/charger will hold the voltage across the batteries at 28.40 Vdc (***56.8 Vdc*** *for the RE48-4500*). The Inverter will do this until the current into the batteries drops to below 55 amps ***(27.5 Adc*** *for the RE48-4500)* or until an hour has gone by and then go on to the next charging stage.

4. Perform the fourth set of charging steps:

a. Set "Charge Step #" to 4. (The fourth charging stage) Press the Top Right Key.

b. The "Charge Stage " is "ABRB" standing for absorption. Press the Top Right Key.

c. The "Charge Type" is "DC CURRENT." Press the Top Right Key.

d. The "Charge Setting" is "50.0 Adc." (***25.0 Adc*** for the RE48-4500) Press the Top Right Key.

e. The "Trigger Type" is ">=DC VOLTAGE." Press the Top Right Key.

f. The "Trigger Settng" is "30.00 Vdc (***60 Vdc*** *for the RE48-4500*)." Press the Top Right Key.

g. And last, the "Charge Timeout" is "0.25 Hours." Press the Top Right Key to take you back to “Charge Step #”.

During this fourth charging stage, the inverter/charger will provide 50 amps (***25 amps*** *for the RE48-4500*) into the batteries. The Inverter will continue to do this until the battery’s voltage have risen to 30 volts or until 15 minutes has gone by, at which time the inverter will then go to the next charging stage.

5. Perform the fifth set of charging steps:

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a. Set "Charge Step #" to 5. (The fifth charging stage) Press the Top Right Key.

b. The "Charge Stage " is "EQUL" standing for equalization. Press the Top Right Key.

c. The "Charge Type" is "DC VOLTAGE." Press the Top Right Key.

d. The "Charge Setting" is "31.00 Vdc." (***62 Vdc*** *for the RE48-4500*) Press the Top Right Key.

e. The "Trigger Type" is "<DC CURRENT." Press the Top Right Key.

f. The "Trigger Settng" is "10.00 Adc." (***5 Adc*** *for the RE48-4500*) Press the Top Right Key.

g. And last, the "Charge Timeout" is "0.25 Hours." Press the Top Right Key to take you back to “Charge Step #”.

During this, fifth equalization charging stage, the inverter/charger will hold the battery voltage at 31 volts. The inverter will continue to do this until the current into the batteries falls to less than 10 amps or until 15 minutes have gone by, after which the inverter will then go on to the next charging stage.

6. Perform the sixth set of charging steps:

a. Set "Charge Step #" to 6. (The sixth charging stage) Press the Top Right Key.

b. The "Charge Stage " is "FLTV" standing for float voltage. Press the Top Right Key.

c. The "Charge Type" is "DC VOLTAGE." Press the Top Right Key.

d. The "Charge Setting" is "26.40 Vdc." *(****52.8 Vdc*** *for the RE48-4500*) Press the Top Right Key.

e. The "Trigger Type" is ">=DC CURRENT." Press the Top Right Key.

f. The "Trigger Settng" is "50.00 Adc." (***25 Adc*** *for the RE48-4500*) Press the Top Right Key.

g. And last, the "Charge Timeout" is "1.00 Hours." Press the Top Right Key to take you back to “Charge Step #”.

During this sixth, float charging stage, the inverter/charger will hold the battery voltage at 26.4 volts (***52.8 Vdc*** *for the RE48-4500*). The inverter will do this until the current into

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the batteries increases to greater than 50 amps (***25 Adc*** *for the RE48-4500*) or until an hour has gone by, after which the inverter will then go on to the next charging stage.

Note: The current when charging probably won't rise so the only effective trigger is the timeout. This means the batteries will be left on float for at least an hour before going on to the next stage.

7. Perform the seventh set of charging steps:

   a. Use the remote to set "Charge Step #" to 7. (The seventh charging stage) Press the Top Right Key.

   b. "Charge Stage ," the charging stage name, is " END," obviously standing for "end." Press the Top Right Key.

   c. The "Charge Type" is "DC VOLTAGE." Press the Top Right Key.

   d. The "Charge Setting" is "26.40 Vdc," (***52.8 Vdc*** *for the RE48-4500*) like the previous stage. Press the Top Right Key.

   e. The "Trigger Type" is ">DC CURRENT." Press the Top Right Key.

   f. The "Trigger Settng" again is "50.00 Adc." (***25 Adc*** *for the RE48-4500*) Press the Top Right Key.

   g. And last, the "Charge Timeout" is "0.00 Hours." Press the ESC Key to take you up the charging menu tree.

   This last charge step is kind of a placeholder where the batteries are left at float, forever.

   Note: The last step is a trigger to stop the generator if "Generator Strt" is ON.

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5 Preventive Maintenance and Trouble Shooting Procedures

There are no user serviceable components inside the inverter. If the inverter requires service, refer to the Vanner Incorporated or other qualified service personnel.

Preventive Maintenance

For continued reliability and safety, a monthly maintenance program should be implemented to include the following:

1. Check to insure that all wiring connections are tight, secure and corrosion free.
2. Check fan exhaust and intake vents for obstructions.
3. Examine connectors, indicators and switches for cracks and breaks.
4. Examine any surfaces that are discolored or deformed due to excessive heat.

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Trouble Shooting Procedures

The following are the most common questions heard by Vanner service professionals. If your situation does not apply to the following categories, please contact your local Vanner Inc. Service Center or the Vanner Inc. Customer Service Department: 1-800-AC-POWER (1-800-227-6937). Please have your model and serial number available when consulting customer service.

Preliminary Checks

1. Indicator Light status.
2. Inverter ON/OFF Switch position.
3. Battery voltage at battery and battery voltage at the inverter terminals. Voltage present at inverter/charger does not prove that all connections are sound especially under no AC load.
4. DC Fuse condition
5. DC Disconnects condition
6. Battery connections for tightness or corrosion

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Problem Symptoms and Troubleshooting Checks

If you have this problem:	Do this:
Inverter Indicator Light does not turn ON.	Verify DC voltage at the inverter.
Inverter Indicator Light is ON but the AC load will not operate.	Check and reset GFCI receptacle or circuit breakers. Verify AC wiring. Try a different load such as a trouble light.
Low Battery Indicator Light is ON when AC load is applied.	Check battery connections and condition. Recharge battery if voltage is less than 22.0 VDC (***44 VDC*** *for the RE48-4500*). Low battery warning is 22 VDC and Inverter Shutdown is 21 VDC (***44 VDC and 42 VDC*** *for the RE48-4500 respectively*). Check to see if Charger is enabled in RE-ICC Settings Menu. Check alarm status on Charger.
Over Temperature Indicator Light is RED.	Verify fan operation. Remove obstructions from air intake vents and exhaust fan.
Inverter Light Turns RED when AC load is applied.	Verify AC load is within the inverter's rated capacity. Remove excessive loads.
DC fuse blows when connecting DC input cables.	Check for reverse polarity (Positive and negative DC cables reversed.)
AC loads do not seem to be fully energized when operating from inverter power.	Check AC output voltage at AC Output Terminals. Check for overheated DC or AC wiring. Verify AC load specifications are not exceeded.
Unit does not operate and a "burnt wire" smell emits from inverter/charger.	Disconnect AC loads and DC Source immediately. Unit may require service, contact Vanner service department.

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Appendix A: Warranty

NORTH AMERICAN LIMITED WARRANTY

Vanner Inc., doing business as The Vanner Inc., referred to herein as Vanner, warrants that this product is free from defects in materials and workmanship for a period of two (2) years from date of installation or two and one half (2 1/2) years from date of manufacture, whichever is less if and only if the following requirements are complied with:

1. The product is installed and checked out properly according to all guidelines, instructions, and checkout procedures set forth in the product Installation and Operating Manual.
2. The installer records all checkout data required and completes, signs, and returns the warranty registration card to Vanner within ten (10) days after installation.
3. The product was purchased after January 1, 2000.

Vanner does not warrant its products against any and all defects when: defect is a result of material or workmanship not provided by Vanner; normal wear and tear, or defects caused by misuse or use in contrary to instructions supplied, neglect, accident, reversed polarity, unauthorized repairs and/or replacements.

Vanner does not manufacture this product for use in a life supporting or life sustaining role. Please contact Vanner if you have any questions along this line.

All warranties of merchantability and fitness for a particular purpose: written or oral, expressed or implied, shall extend only for a period of two (2) years from date of installation or two and one half (2 1/2) years from date of manufacture, whichever is first. There are no other warranties that extend beyond those described on the face of this warranty. Some states do not allow limitation on how long an implied warranty lasts, so the above limitations may not apply to you.

Vanner does not undertake responsibility to any purchaser of its product for any undertaking, representation, or warranty made by any dealers or distributors selling its products beyond those herein expressed unless expressed in writing by an officer of Vanner.

Vanner does not assume responsibility for incidental or consequential damages, including, but not limited to, responsibility for loss of use of this product, removal or replacement labor, loss of time, inconvenience, expense for telephone calls, shipping expense, loss or damage to property, or loss of revenue. Some states do not allow the exclusion or limitation of incidental or consequential damages, so these limitations may not apply to you.

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Vanner reserves the right to repair, replace, or allow credit for any material returned under this warranty. Any damage caused by the customer will be charged or deducted from the allowance.

All warranty work will be performed at Vanner's factory, by authorized Vanner distributors, by Vanner installers/technicians, or a Vanner authorized repair facility utilizing a valid Warranty Authorization Number (WAN) prior to repair. Products shall be delivered to Vanner's facility, freight prepaid and fully insured. Products repaired under warranty, or replacement parts or products will be returned to North American location prepaid via same transportation means and level of service as received, unless directed otherwise. Prepaid freight policy does not apply to locations outside North America.

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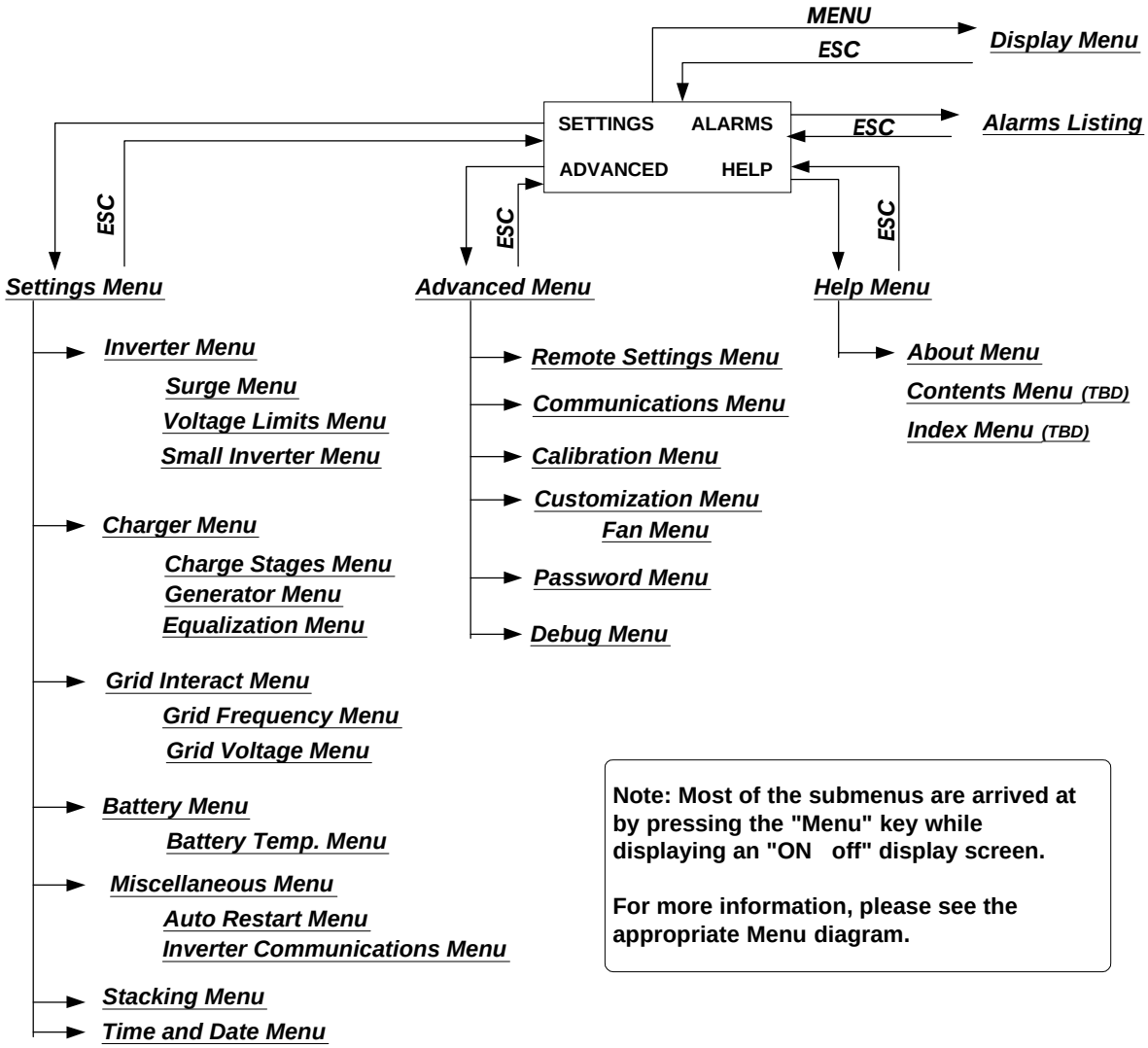
Appendix B: RE-ICC Menus



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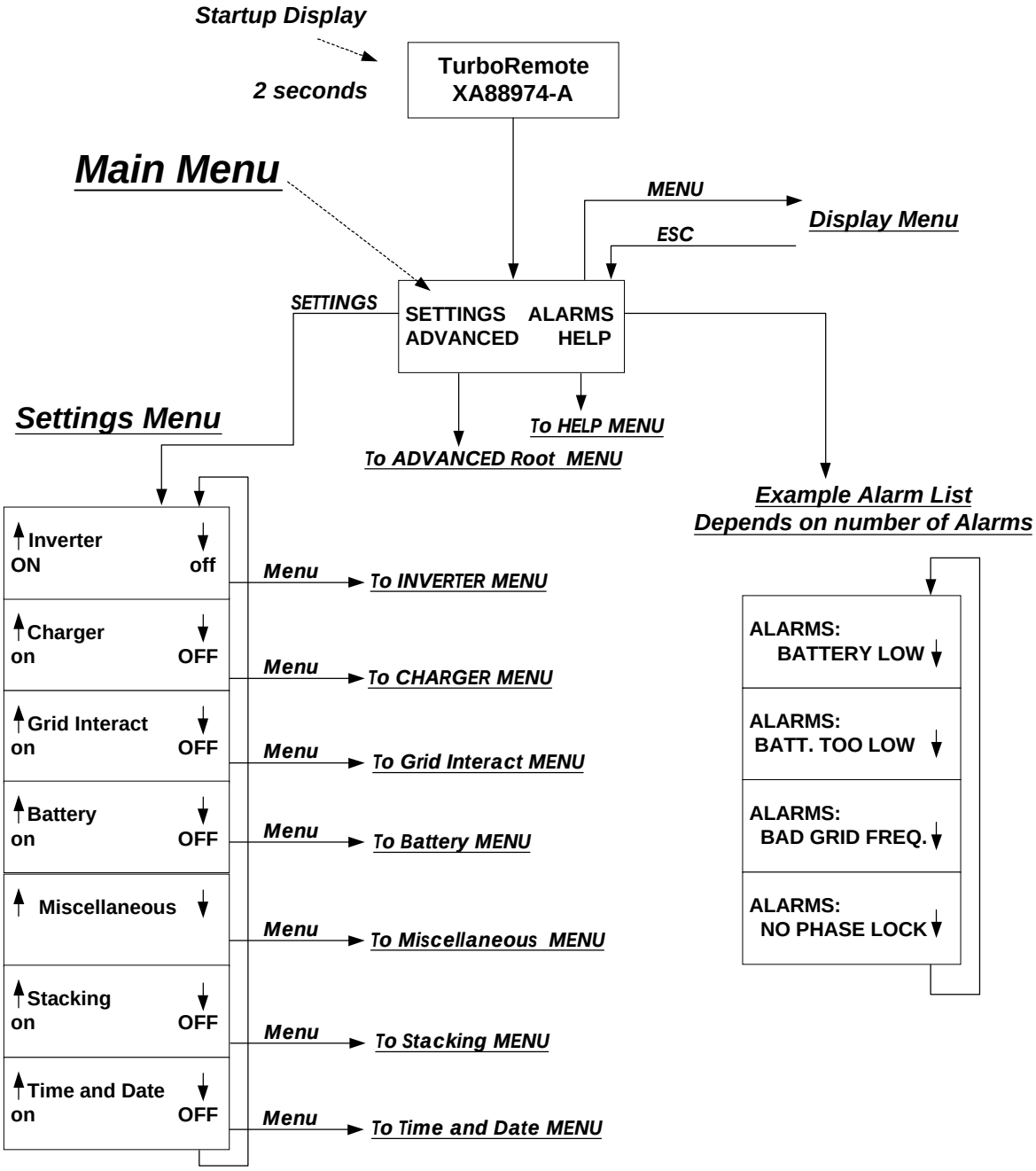

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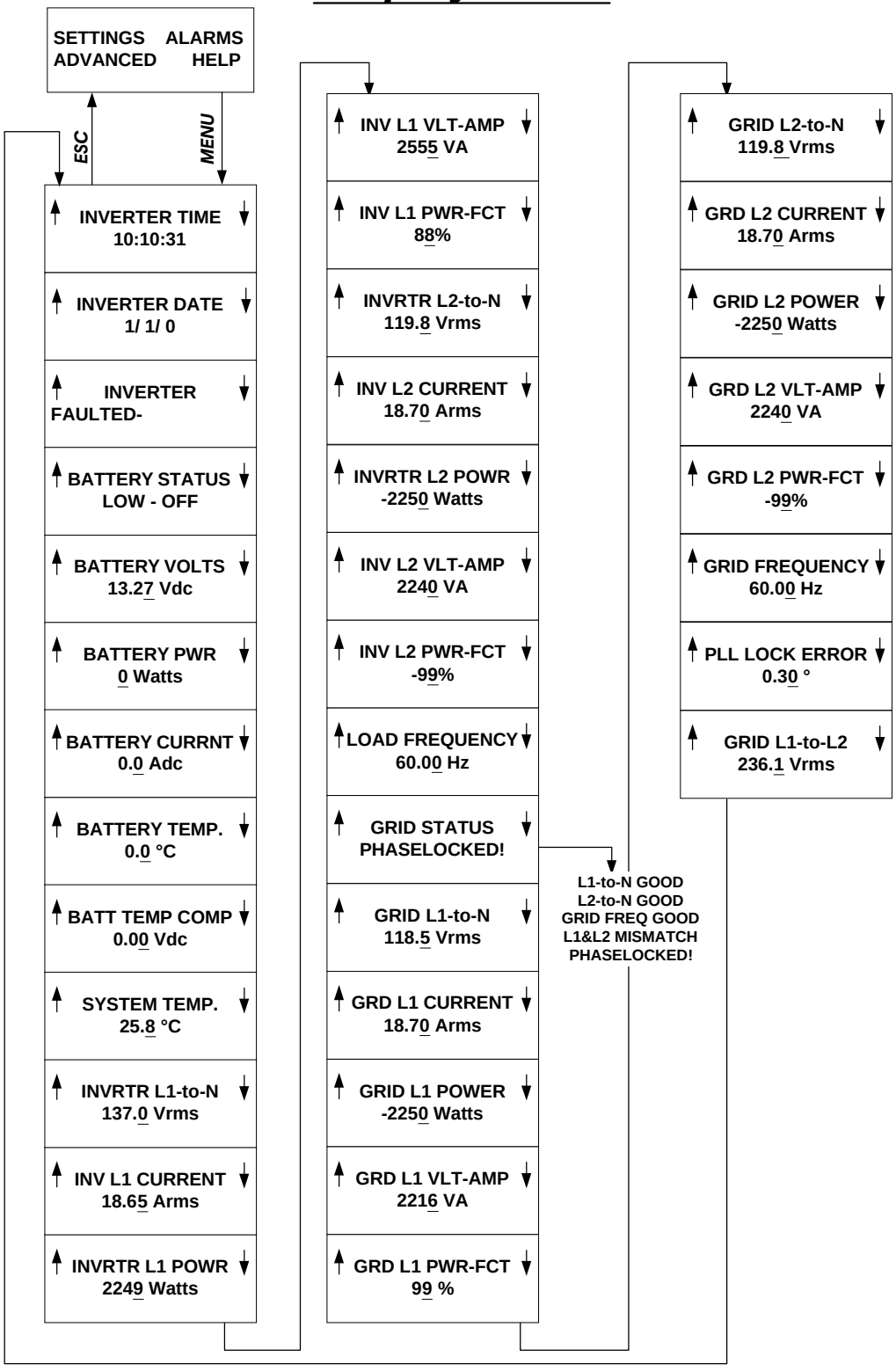
Display Menu



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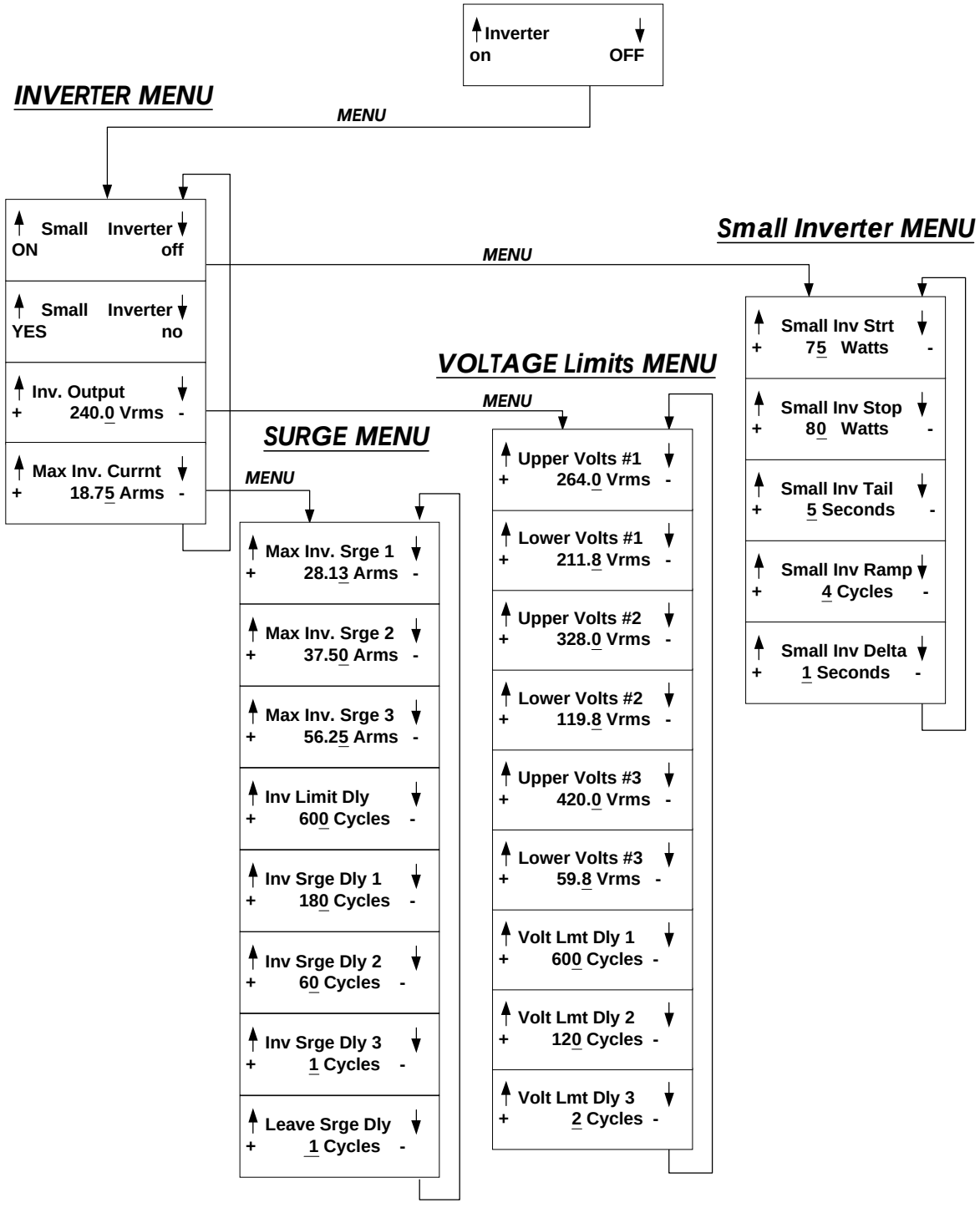
INVERTER MENUS



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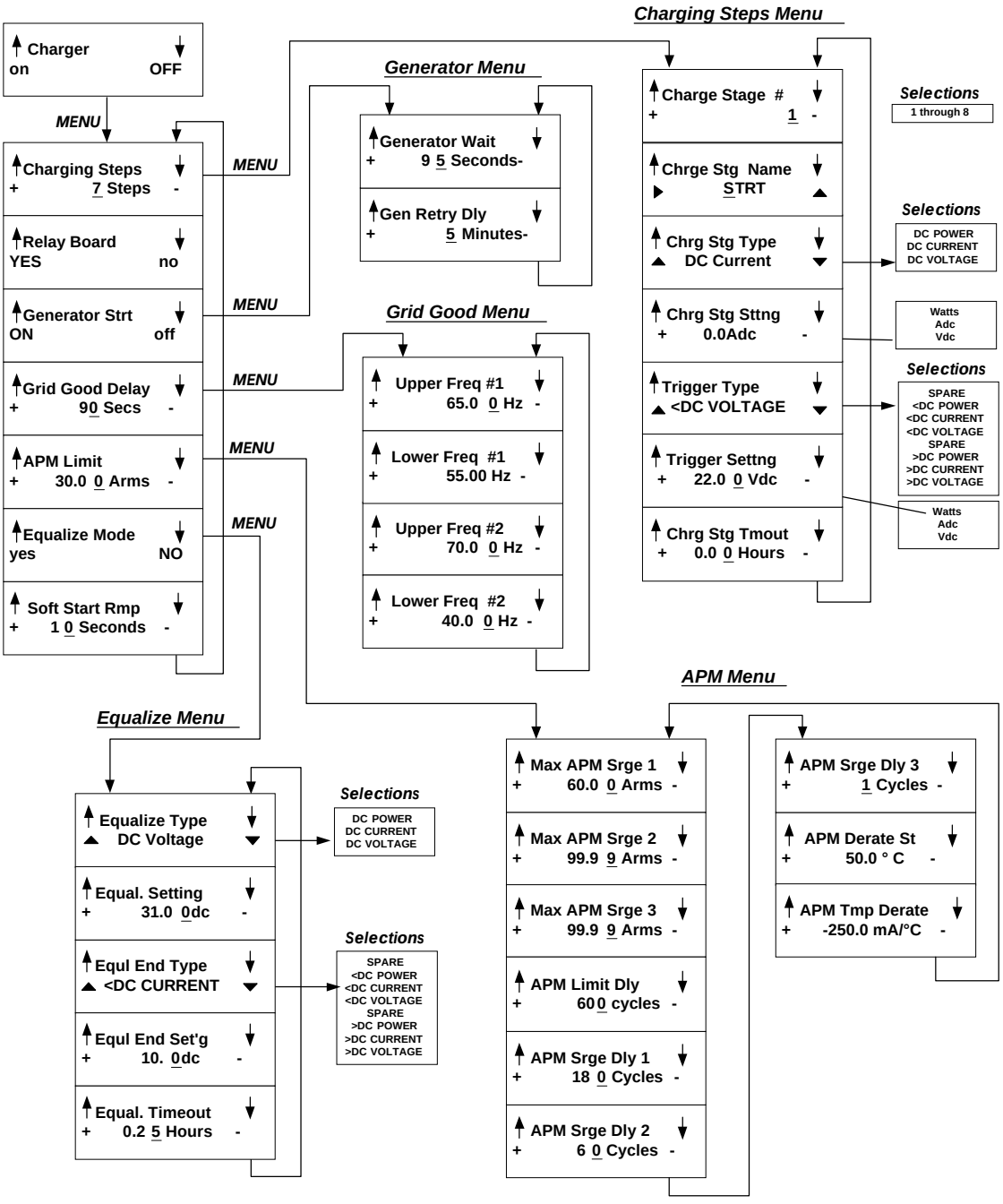
Charger MENU RE24-4500
24V System



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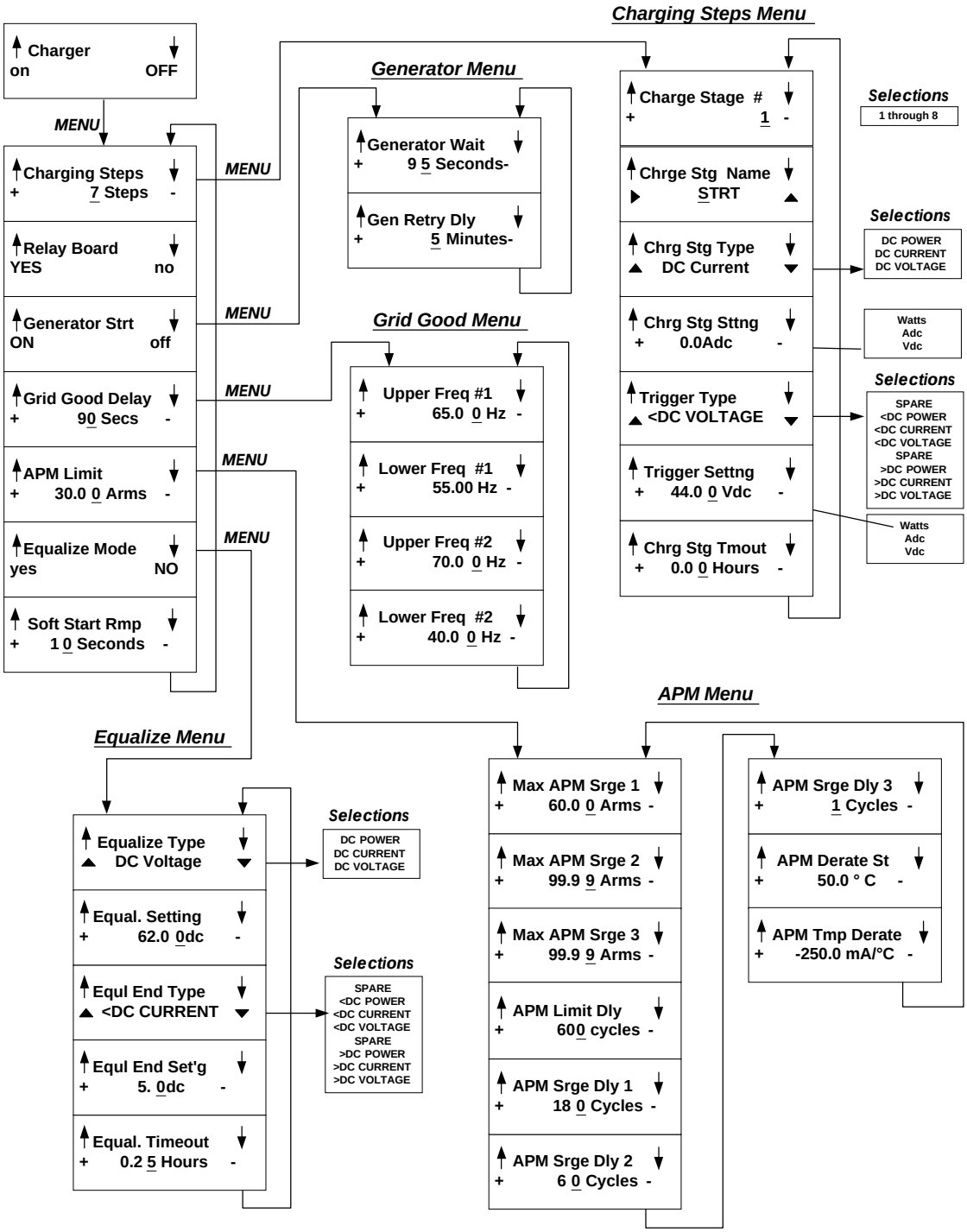
Charger MENU RE48-4500
48V System



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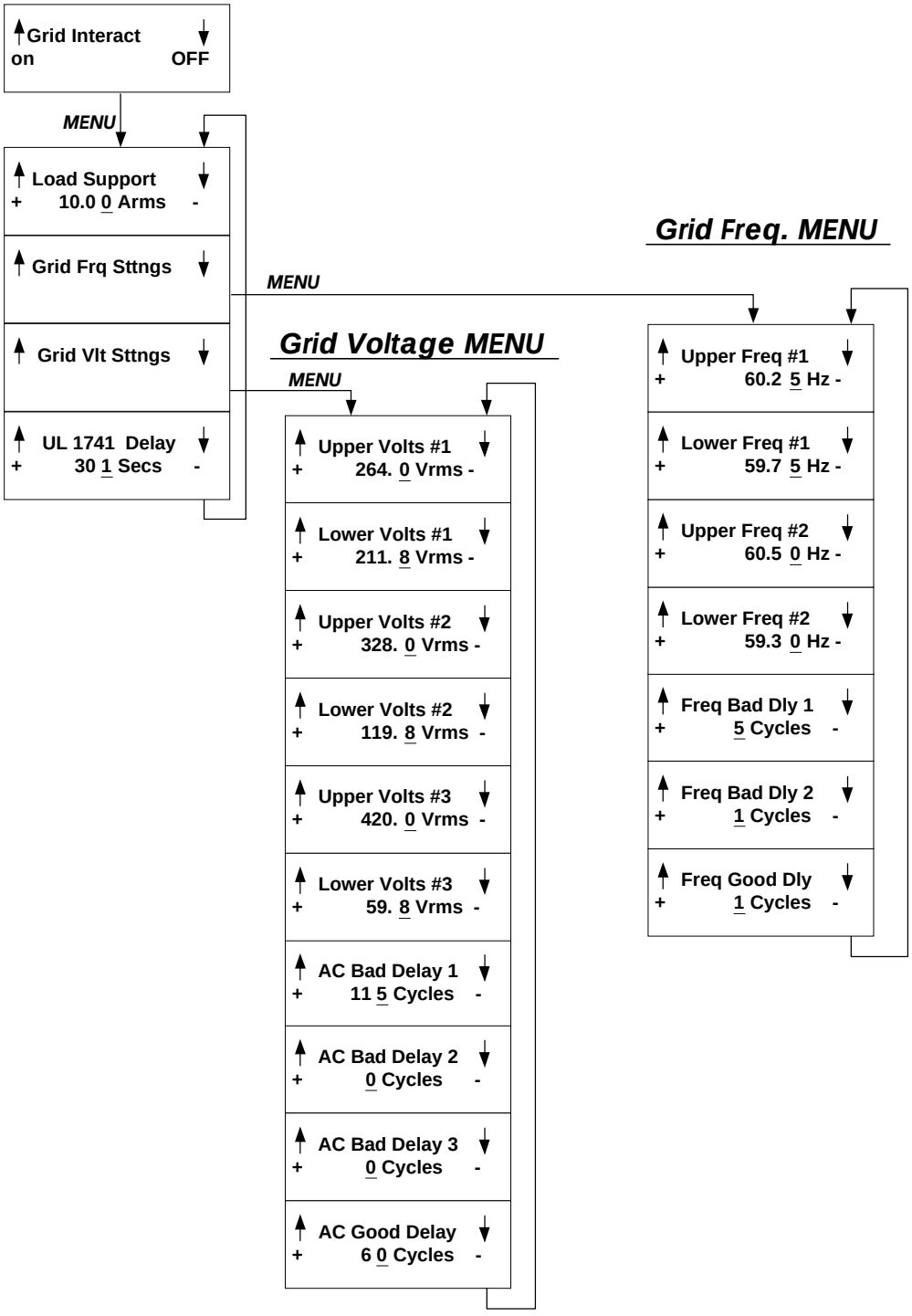
Grid Interact Menus



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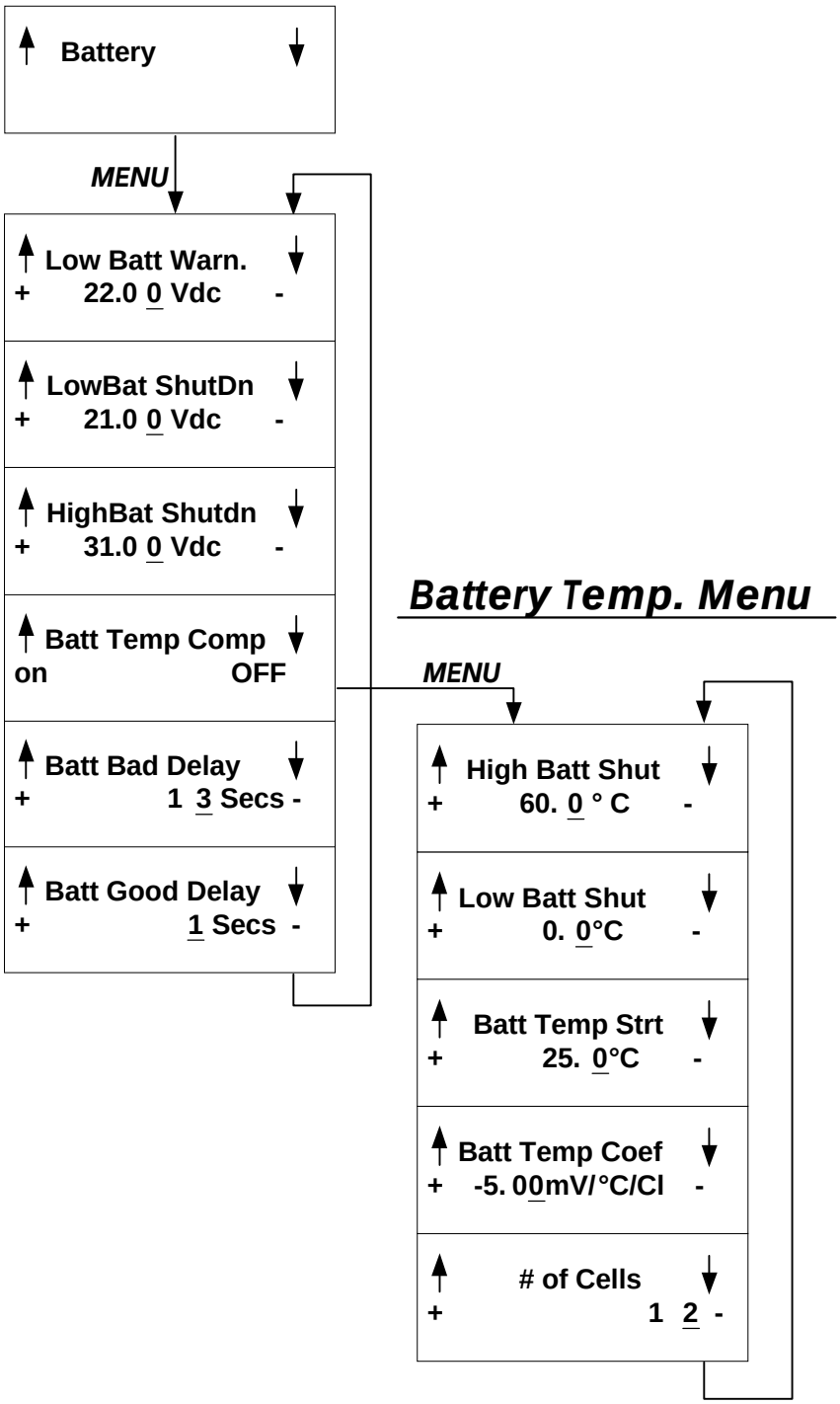
Battery MENU RE24-4500
24 Volt System



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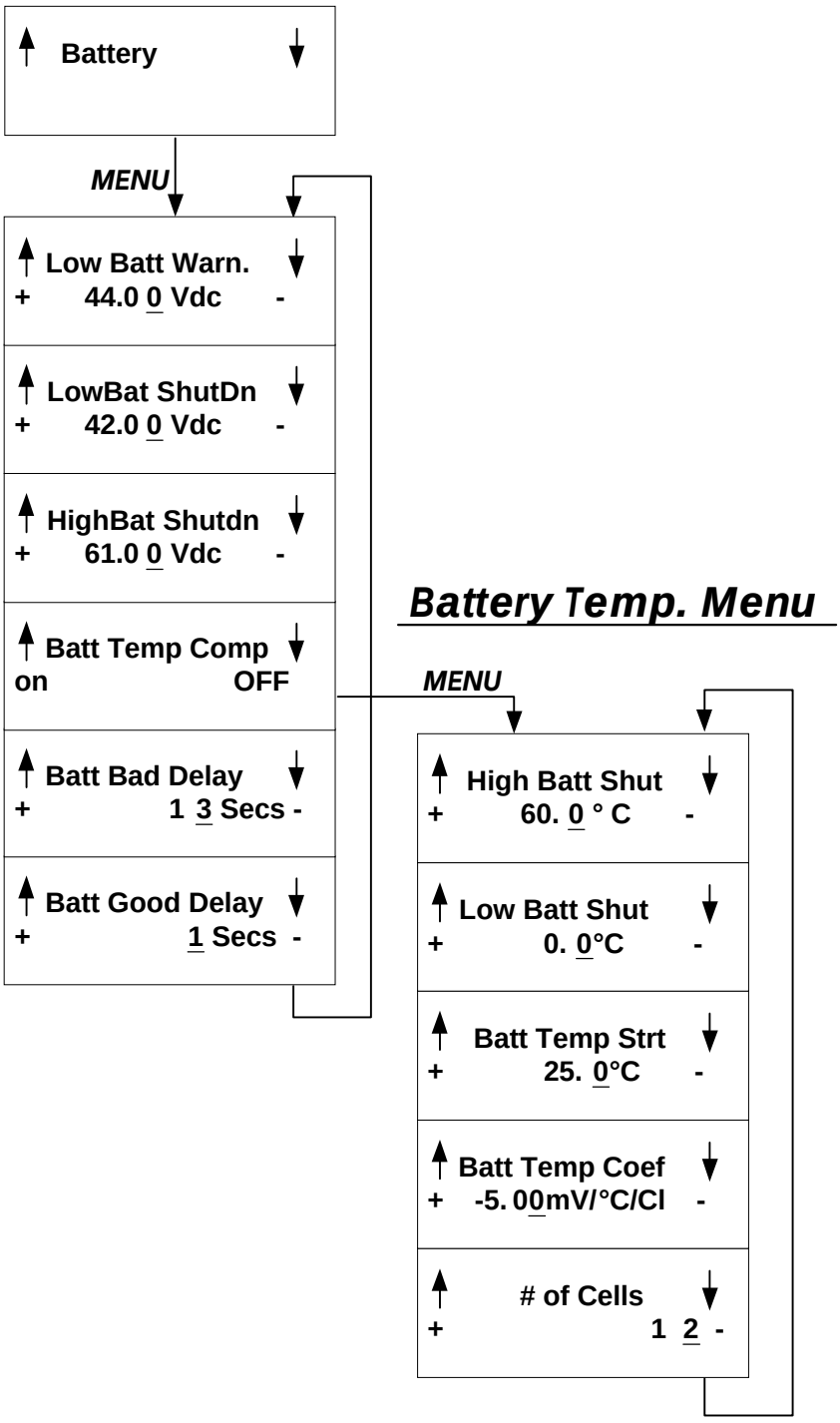
Battery MENU RE48-4500
48 Volt System



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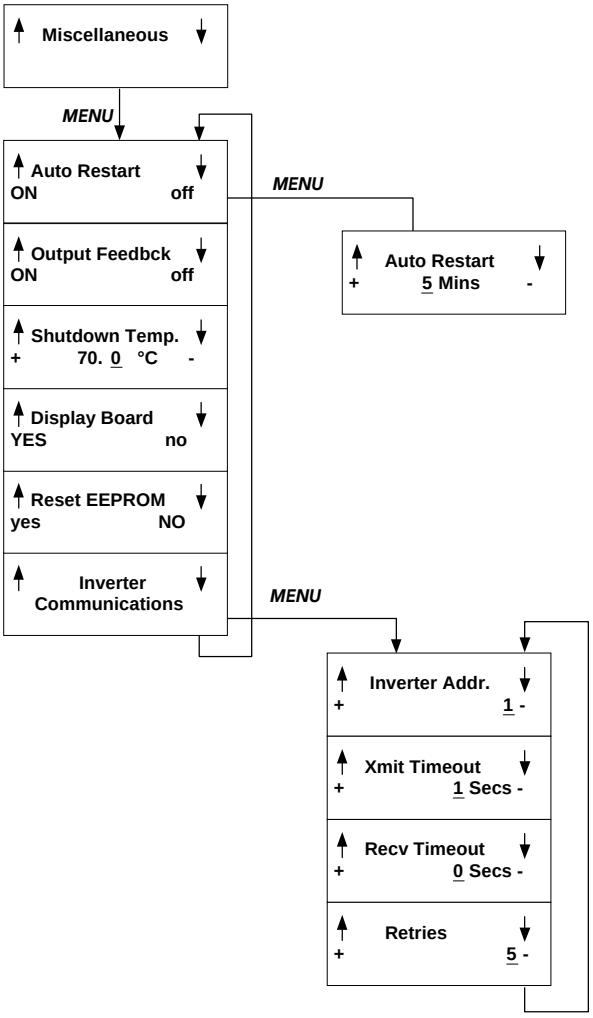
Miscellaneous MENU



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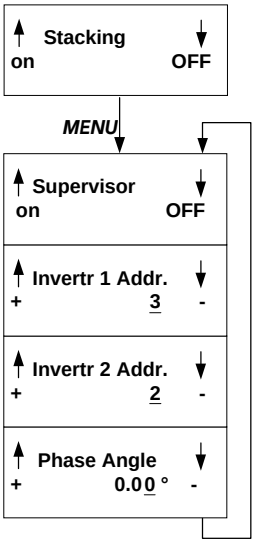
Stacking MENU



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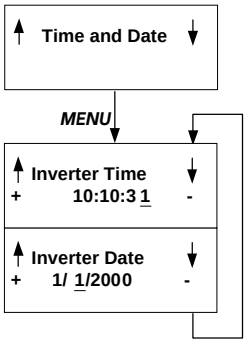

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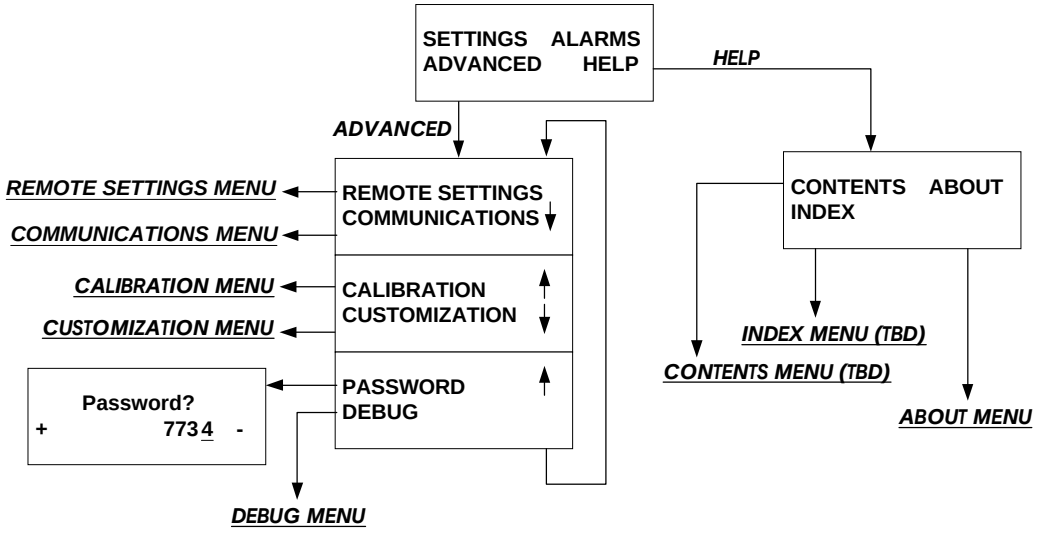
Advanced MENU



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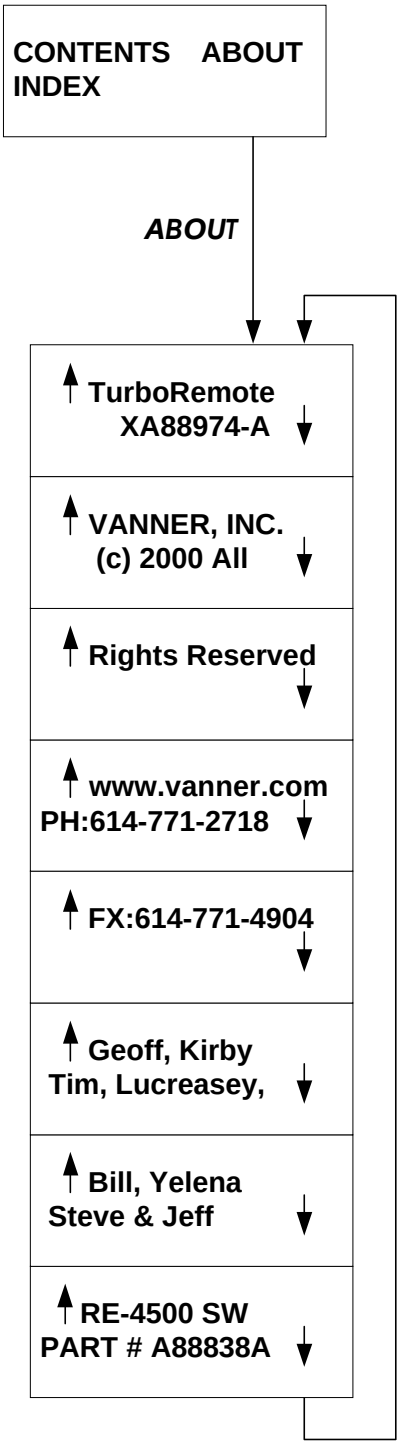
ABOUT MENU



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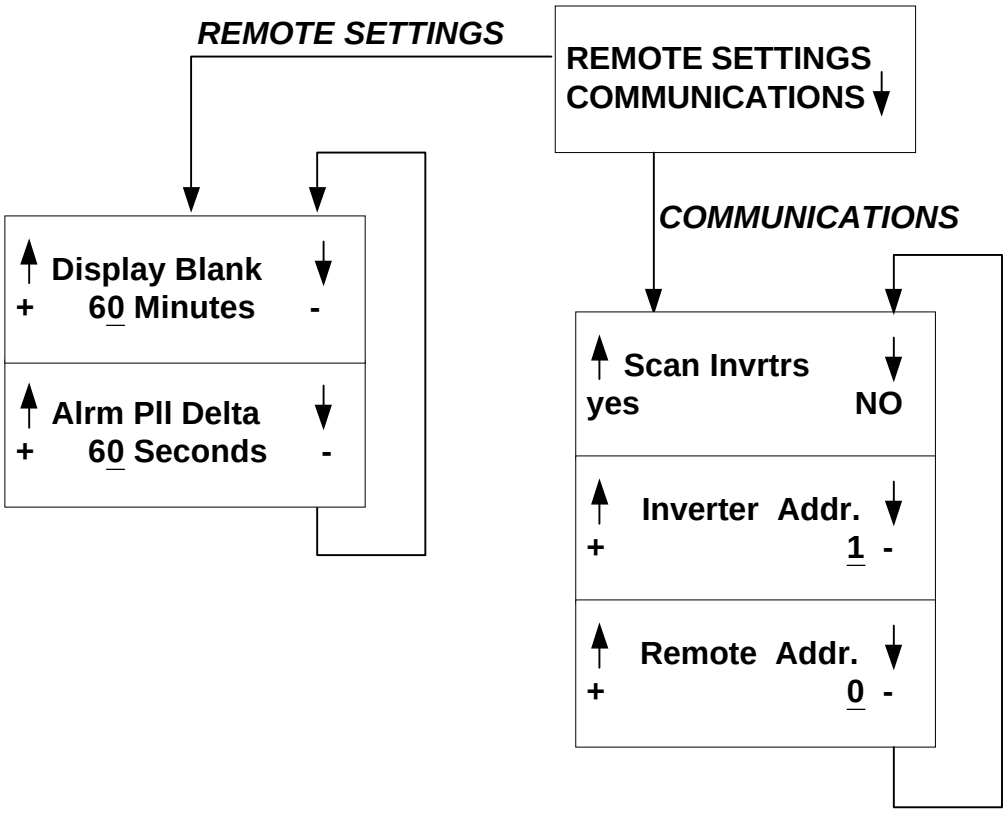
RE-Installation_Manual_Rev01e

REMOTE SETTINGS MENU



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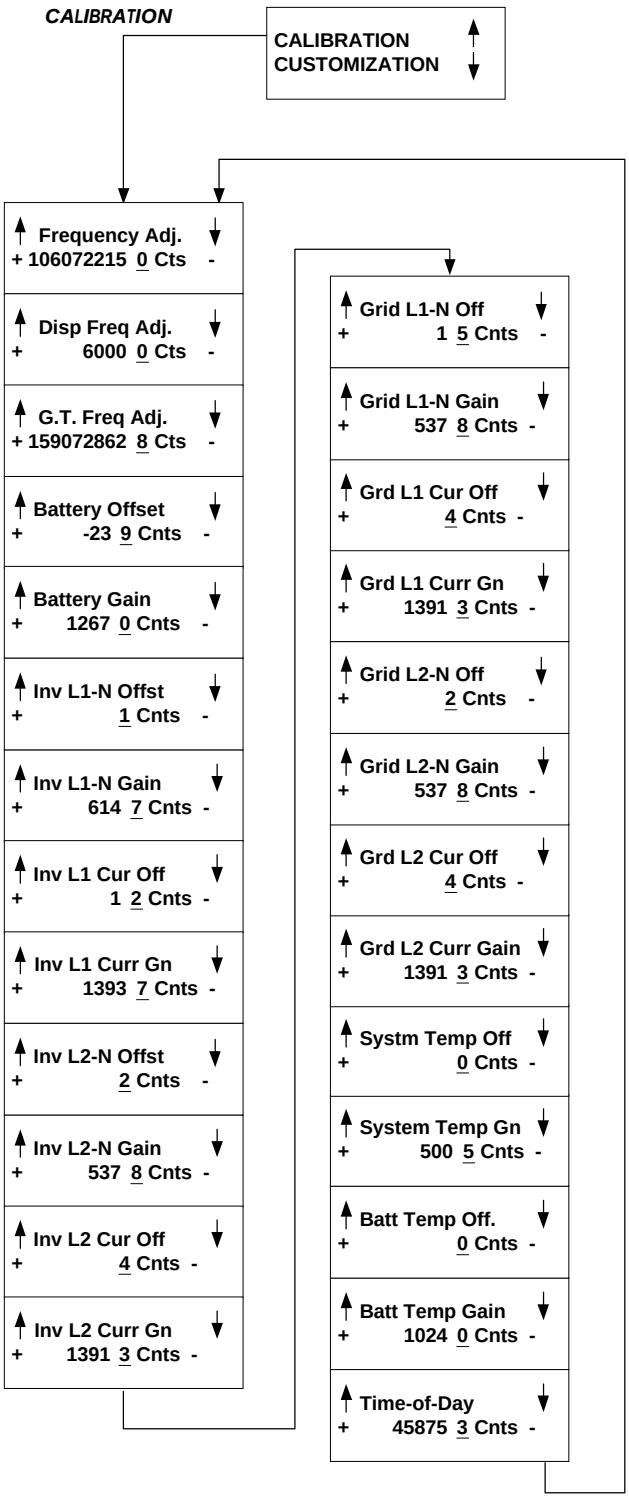
CALIBRATION MENU



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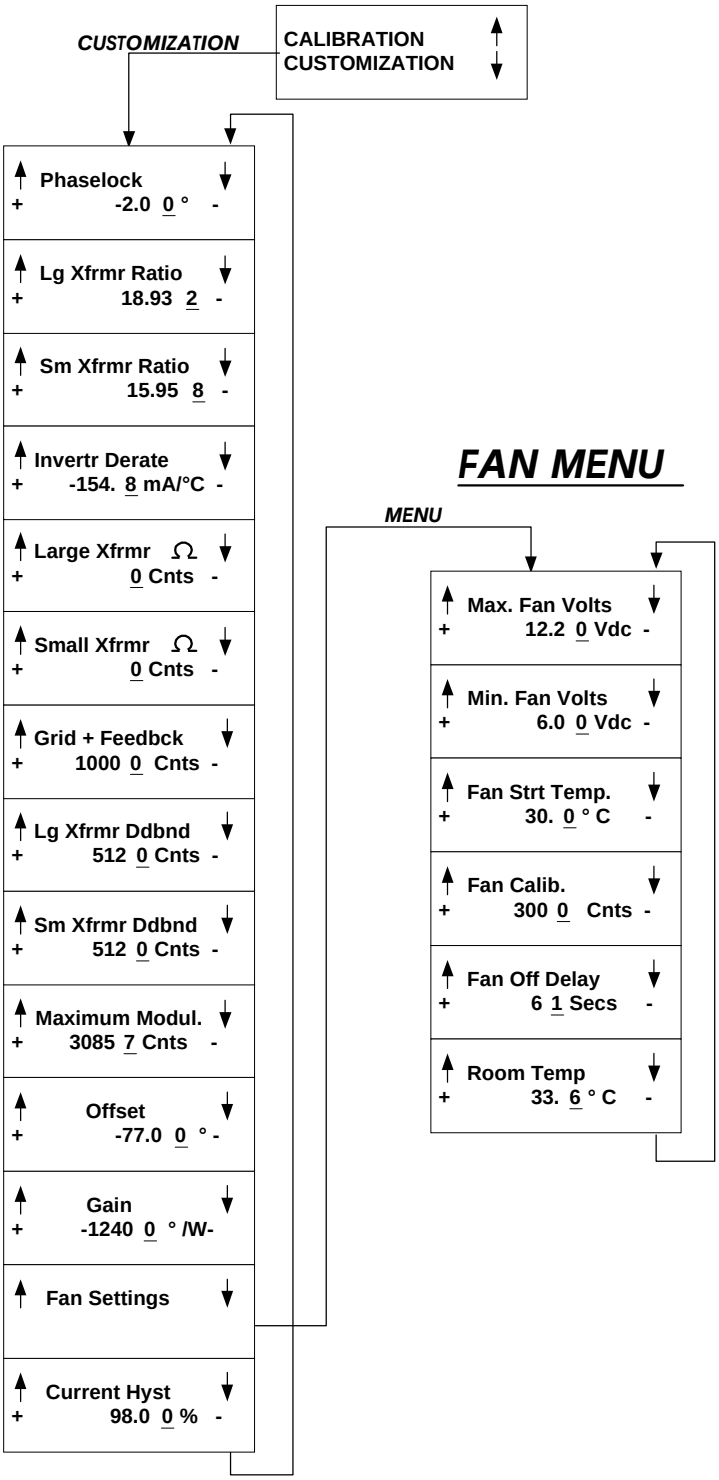
CUSTOMIZATION MENU



FAN MENU

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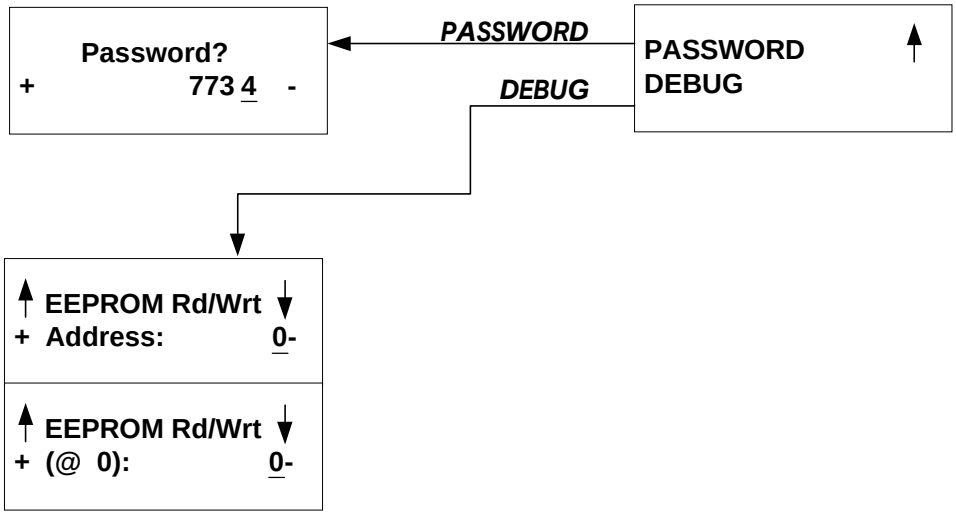
PASSWORD AND DEBUG MENU



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Appendix C: Settings

Alarm Listing

Alarm Display	Description
BATTERY LOW	*Battery Low Warning*
BATT. TOO HIGH	*Battery High Shutdown*
BATT. TOO LOW	*Battery Low Shutdown*
CURRENT LIMIT	*At the Inverter current limit*
BROWNED OUT	*Shutdown because the inverter output voltage has been too low for too long*
BRICK FAULT	*Power stage shutdown*
XFRMR OVERHEAT	*Transformer overheated*
BRICK OVERHEAT	*The power stage overheated*
BATT. OVERHEAT	*The batteries overheated. Note: Battery temperature compensation must be ON*
SYS. OVERHEAT	*The internal temperature sensor reported >60 degrees C.*
SURGING...	*The load is greater than the inverter current limit; not limiting yet.*
BAD GRID FREQ.	*The utility or generator frequency is bad. (The voltage might be OK).*
PHASE MISMATCH	*Line 1 and Line 2 voltages don't agree.*
NO PHASELOCK	*The transfer relay has not yet energized. The voltage and frequency of the grid might be OK.*
GRID L1-N BAD	*Bad phase voltages*
GRID L2-N BAD	*Bad phase voltages*
OPEN FUSE	*The small inverter has blown its fuse*
SOFTWARE FAULT	*Software error - Checksum*
BATTERY DEAD	*Battery Low Shutdown, no charging. < 1/2 Battery Low Shutdown value.*
INVERTING	*Normal*
INVERTING-SMAL	*Inverting “low power” with small inverter*

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L1-N OUT BROWN	*L1 in current regulation mode (brown-out)*
L2-N OUT BROWN	*L2 in current regulation mode (brown-out)*
L1 IN SURGING	*L1 Coming up on APM limit*
L2 IN SURGING	*L2 Coming up on APM limit*
L1 APM LIMIT	*L1 is at APM Limit*
L2 APM LIMIT	*L2 is at APM Limit*

Factory Settings 24 VDC Only!!

SETTING NAME	FACTORY VALUE	DEFAULT VALUE
EEPROM Version	**value**	**value**

Battery Settings		
SETTING NAME	**FACTORY VALUE**	**DEFAULT VALUE**
Number of Cells	12	12
High Battery Shutdown	31.00 Vdc	31.00 Vdc
Low Battery Shutdown	21.00 Vdc	21.00 Vdc
Low Battery Warning	22.00 Vdc	22.00 Vdc
Battery Offset	-239	-239
Battery Gain	12670	12670
Battery Temperature Coefficient	-5.00 mV/degrees C/Cell	-5.00 mV/degrees C/Cell
High Battery Shutdown Temperature	60.0 degrees C	60.0 degrees C
Battery Temperature Offset	0	0
Battery Temperature Gain	10240	10240
Battery Bad Delay	13 S	13 S
Battery Bad Temperature Delay	1 S	1 S

Frequency Settings		
SETTING NAME	**FACTORY VALUE**	**DEFAULT VALUE**
1st Frequency Bad Delay (UL1741)	5 Cycles	5 Cycles
2nd Frequency Bad Delay (UL1741)	1 Cycle	1 Cycle
Displayed Frequency Adjust	60000	60000
Frequency Good Delay	1 Cycle	1 Cycle
Generator Upper Capture Frequency	65.00 Hz	65.00 Hz
Generator Lower Capture Frequency	55.00 Hz	55.00 Hz
Generator Upper Lock Frequency	70.00 Hz	70.00 Hz
Generator Upper Lock Frequency	40.00 Hz	40.00 Hz
Stacking Phase Angle	0.00 degrees	0.00 degrees
Phaselock Detect Angle	2.00 degrees	2.00 degrees
Frequency Adjust	1060722150	1060722150
GridTie Frequency Adjust (not used)	1590728628	1590728628
Grid Interactive Upper Capture Frequency	60.25 Hz	60.25 Hz
Grid Interactive Lower Capture Frequency	59.75 Hz	59.75 Hz
Grid Interactive Upper Lock Frequency	60.50 Hz	60.50 Hz
Grid Interactive Lower Lock Frequency	59.30 Hz	59.30 Hz
Generator Good Timeout	1 S	90 S
Phaselock Bad Timeout	2 Cycles	2 Cycles

Temperature Settings		
SETTING NAME	**FACTORY VALUE**	**DEFAULT VALUE**
High Temperature Shutdown	70.00 degrees C	70.00 degrees C
Low Temperature Shutdown	-40.00 degrees C	-40.00 degrees C
System Temperature Offset	0	0
System Temperature Gain	5005	5005
Maximum Fan Volts	12.20 Vdc	12.20 Vdc
Minimum Fan Volts	6.00 Vdc	6.00 Vdc
Fan Start Temperature	30.0 degrees C	30.0 degrees C
Fan Off Delay	61 S	61 S
Fan Calibration	3000	3000
Room Temperature Setting	35.0 degrees C	35.0 degrees C

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Communications Settings		
SETTING NAME	**FACTORY VALUE**	**DEFAULT VALUE**
Inverter #1 Address	3	3
Inverter #2 Address	2	2
Inverter Address	1	1
Inverter Transmit Timeout	1 S	1 S
Inverter Receive Timeout	1 S	1 S
Inverter Number of Retries	5	5

Systems Settings		
SETTING NAME	**FACTORY VALUE**	**DEFAULT VALUE**
Automatic Restart Timeout	5 Minutes	5 Minutes
ON/OFF Controls:		
Subordinate	ON	ON
Stacking	OFF	OFF
Grid Interactive	OFF	OFF
Charger	OFF	OFF
Inverter	OFF	OFF
Automatic Restart	ON	ON
Small Inverter	ON	ON
Load Demand	OFF	OFF
Generator Start	OFF	OFF
Battery Temperature Compensation	OFF	OFF
Output Feedback	ON	ON
Small Inverter Board	YES	YES
Relay Board	YES	YES
Display Board	YES	YES
Inverter Software Part Number	A88838C	A88838C
Large Transformer Deadband	5120	5120
Small Transformer Deadband	5120	5120
Extra Deadband	5120	5120
Maximum Modulation Limit	30857	30857
APM Limit Delay	600 Cycles	600 Cycles
APM Surge Delay 1	180 Cycles	180 Cycles
APM Surge Delay 2	60 Cycles	60 Cycles
APM Surge Delay 3	1 Cycle	1 Cycle
Inverter Current Limit Delay	600 Cycles	600 Cycles
Inverter Surge Delay 1	180 Cycles	180 Cycles
Inverter Surge Delay 2	60 Cycles	60 Cycles
Inverter Surge Delay 3	1 Cycle	1 Cycle

Systems Settings		
SETTING NAME	**FACTORY VALUE**	**DEFAULT VALUE**
APM Limit	30.00 Arms	30.00 Arms
APM Surge Limit 1	60.00 Arms	60.00 Arms
APM Surge Limit 2	105.00 Arms	105.00 Arms
APM Surge Limit 3	300.00 Arms	300.00 Arms
Grid L1 Current Offset	4	4
Grid L2 Current Offset	4	4
Grid L1-to-N Offset	15	15
Grid L2-to-N Offset	2	2
Inverter L1 Current Offset	12	12
Inverter L2 Current Offset	4	4
Inverter L1-to-N Offset	1	1
Inverter L2-to-N Offset	2	2
Grid L1 Current Gain	13913	13913
Grid L2 Current Gain	13913	13913
Grid L1-to-N Gain	5378	5378
Grid L2-to-N Gain	5378	5378
Inverter L1 Current Gain	13913	13913
Inverter L2 Current Gain	13913	13913
Inverter L1-to-N Gain	5378	5378
Inverter L2-to-N Gain	5378	5378
Upper Voltage Limit #1	264.0 Vrms	264.0 Vrms
Upper Voltage Limit #2	328.0 Vrms	328.0 Vrms
Upper Voltage Limit #3	420.0 Vrms	420.0 Vrms
Lower Voltage Limit #1	211.8 Vrms	211.8 Vrms
Lower Voltage Limit #2	119.8 Vrms	119.8 Vrms
Lower Voltage Limit #3	59.8 Vrms	59.8 Vrms
AC Bad Delay #1	115 Cycles	115 Cycles
AC Bad Delay #2	2 Cycles	0 Cycles
AC Bad Delay #3	0 Cycle	0 Cycle
Inverter Voltage Limit Delay #1	600 Cycles	600 Cycles
Inverter Voltage Limit Delay #2	120 Cycles	120 Cycles
Inverter Voltage Limit Delay #3	10 Cycles	2 Cycles
AC Good Delay	60 Cycles	60 Cycles
Current Hysteresis	98.00%	98.00%
Grid L1-to-N Power Gain	-6662	-6662
Grid L2-to-N Power Gain	-6662	-6662
Inverter L1-to-N Power Gain	-6662	-6662
Inverter L2-to-N Power Gain	-6662	-6662

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Inverting Settings		
SETTING NAME	**FACTORY VALUE**	**DEFAULT VALUE**
Inverter Output Voltage	240.0 Vrms	240.0 Vrms
Large Transformer Output Ohms	0	0
Tap Transformer Output Ohms (not used)	0	0
Small Transformer Output Ohms	0	0
Maximum Inverter Current	18.75 Arms	18.75 Arms
Maximum Inverter Surge Current #1	28.13 Arms	28.13 Arms
Maximum Inverter Surge Current #2	37.50 Arms	37.50 Arms
Maximum Inverter Surge Current #3	56.25 Arms	56.25 Arms
Small Inverter / Load Demand Ramp Up/Down	13 Cycles	4 Cycles
Small Inverter / Load Demand Exit	80 Watts	80 Watts
Small Inverter / Load Demand Start	75 Watts	75 Watts
Small Inverter / Load Demand Tail	5 S	5 S
Small Inverter / Load Demand Delta	1 S	1 S

Charging Settings		
SETTING NAME	**FACTORY VALUE**	**DEFAULT VALUE**
Charge Stage #1		
Charge Stage Name	"STRT"	"STRT"
Charge Stage Type	DC POWER	DC CURRENT
Trigger Type	< DC VOLTAGE	< DC VOLTAGE
Charge Stage Setting	-300 W	0.0 Adc
Trigger Setting	22.00 Vdc	22.00 Vdc
Charge Stage Timeout	0.00 Hours	0.00 Hours
Charge Stage #2		
Charge Stage Name	"BLKC"	"BLKC"
Charge Stage Type	DC CURRENT	DC CURRENT
Trigger Type	>= DC VOLTAGE	>= DC VOLTAGE
Charge Stage Setting	100.0 Adc	100.0 Adc
Trigger Setting	28.40 Vdc	28.40 Vdc
Charge Stage Timeout	24.00 Hours	24.00 Hours
Charge Stage #3		
Charge Stage Name	"BLKV"	"BLKV"
Charge Stage Type	DC VOLTAGE	DC VOLTAGE
Trigger Type	< DC CURRENT	< DC CURRENT
Charge Stage Setting	28.4 Vdc	28.4 Vdc
Trigger Setting	55.0 Adc	55.0 Adc
Charge Stage Timeout	1 Hour	1 Hour
Charge Stage #4		
Charge Stage Name	"ABRB"	"ABRB"
Charge Stage Type	DC CURRENT	DC CURRENT
Trigger Type	>= DC VOLTAGE	>= DC VOLTAGE
Charge Stage Setting	50.0 Adc	50.0 Adc
Trigger Setting	30.00 Vdc	30.00 Vdc
Charge Stage Timeout	0.25 Hour	0.25 Hour
Charge Stage #5		
Charge Stage Name	"EQUL"	"EQUL"
Charge Stage Type	DC VOLTAGE	DC VOLTAGE
Trigger Type	< DC CURRENT	< DC CURRENT
Charge Stage Setting	31.00 Vdc	31.00 Vdc
Trigger Setting	10.00 Adc	10.00 Adc
Charge Stage Timeout	0.25 Hour	0.25 Hour
Charge Stage #6		
Charge Stage Name	"FLTV"	"FLTV"
Charge Stage Type	DC VOLTAGE	DC VOLTAGE
Trigger Type	>= DC CURRENT	>= DC CURRENT
Charge Stage Setting	26.40 Vdc	26.40 Vdc
Trigger Setting	50.00 Adc	50.00 Adc
Charge Stage Timeout	1 Hour	1 Hour

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Charge Stage #7		
Charge Stage Name	"END "	"END "
Charge Stage Type	DC VOLTAGE	DC VOLTAGE
Trigger Type	>= DC VOLTAGE	>= DC VOLTAGE
Charge Stage Setting	26.40 Vdc	26.40 Vdc
Trigger Setting	50.0 Adc	50.0 Adc
Charge Stage Timeout	0.00 Hours	0.00 Hours
Charge Stage #8		
Charge Stage Name	"EQUL"	"EQUL"
Charge Stage Type	DC VOLTAGE	DC VOLTAGE
Trigger Type	< DC CURRENT	< DC CURRENT
Charge Stage Setting	31.00 Vdc	31.00 Vdc
Trigger Setting	10.00 Adc	10.00 Adc
Charge Stage Timeout	0.25 Hour	0.25 Hour
Number of Charging Stages	1	7
Charging Soft Start Ramping Time	10 S	10 S

More Systems Settings

SETTING NAME	FACTORY VALUE	DEFAULT VALUE
Large Transformer Turns Ratio	18.932	18.932
Tap Transformer Turns Ratio (not used)	9.466	9.466
Small Transformer Turns Ratio	15.958	15.958
Load Support Current	10.00 Arms	10.00 Arms
Small Inverter Dead	40 VA	0 VA
Phase Angle Offset	-77.00 degrees	-77.00 degrees
Phase Angle Gain	-12400 degrees / W	-12400 degrees / W
Leaving Surge / Current Limit Timeout	1 Cycle	1 Cycle
Exiting Charge Stage Timeout	30 Cycles	30 Cycles
Generator Wait	95 S	95 S
Generator Start Retry Delay	5 Minutes	5 Minutes
Grid Positive Feedback Gain (UL1741)	32000	10000
Inverter Current Derating	-154.8 mArms/degrees C	-154.8 mArms/degrees C
Battery Temperature Compensation Start Temperature	25.0 degrees C	25.0 degrees C
Low Battery Shutdown Temperature	0.0 degrees C	0.0 degrees C
Grid Interactive Good Timeout (UL1741)	5 Minutes	5 Minutes
Time-of-Day Calibration	483333	483333
APM Current Derating	-250.0 mArms/degrees C	-250.0 mArms/degrees C
APM Current Derating Start Temperature	50.0 degrees C	50.0 degrees C
L1-to-L2 Voltage Gain	65283	65283
Grid L1-to-N Power Offset	0	0
Grid L2-to-N Power Offset	0	0
Inverter L1-to-N Power Offset	0	0
Inverter L2-to-N Power Offset	0	0
CRC	value	value

Appendix D: Application Notes

Application Notes

Please refer to the Vanner Incorporated Web site for Application notes at: http://www.vanner.com.

Applicable Documents

National Electric Code 1999
NEC Article 690
UL-1741
IEEE-929
[1] G.A. Kern, R.H.Bonn, J. Ginn, S. Gonzalez *Results of Sandia National Laboratories Grid-Tied Inverter Testing*, July 1998

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